VOL. XIX DECEMBER, 1935 No. 6

THE JOURNAL OF APPLIED PSYCHOLOGY

JAMES P. PORTER, *Editor*

OHIO UNIVERSITY ATHENS, OHIO

With a Board of Cooperating Editors

SOME INTERESTING CONTRIBUTIONS IN THIS ISSUE:

H. H. HSIAO. A Study of Color-Blindness Among Chinese School Children.

GWENDOLYN SCHILLER. An Experimental Study of Color and Type in Advertising.

OTIS C. TRIMBLE AND DOROTHY H. ASPERGER. The Recognition Spans of Good and Poor Readers: A Comparative Study.

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OHIO UNIVERSITY, ATHENS, OHIO

PRINTED BY THE SCIENCE PRESS PRINTING COMPANY, LANCASTER, PA.

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The Journal of Applied Psychology

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The Journal of Applied Psychology is published bi-monthly. The subscription price is $5.00 a year. Single numbers $1.25 to $2.00, depending upon the number of pages. Remittances and business communications should be addressed to the Editor, James P. Porter, Ohio University, Athens, Ohio.

The Journal of
Applied Psychology

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JAMES P. PORTER
Ohio University
With a Board of Cooperating Editors

VOLUME XIX
1935

PUBLISHED BI-MONTHLY BY THE EDITOR
Ohio University, Athens, Ohio
Printed by
THE SCIENCE PRESS PRINTING COMPANY
Lime and Green Sts., Lancaster, Pa.

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A STUDY OF COLOR-BLINDNESS AMONG CHINESE SCHOOL CHILDREN

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National Central University, Nanking, China

THE study of color-blindness has a theoretical and practical aspect. From the theoretical standpoint such a study may be expected to throw light upon theories of vision, which have now become numerous enough.[1] From the practical standpoint the determination of this phenomenon is of great importance in education, industry and transportation.

A survey of psychological literature will reveal the fact that there are in abundance studies of this kind in America and Europe, but very little attention has, as yet, been given to this problem in China. Realizing this neglect, we have inaugurated an investigation in the Elementary Department of the Experimental School of the National Central University. Results of this preliminary research[2] are to be reported in this paper.

Before presenting our findings it would be worth while to have a review of the results of previous studies in this field. For the sake of both brevity and clearness, these may be summarized in the form of a table,[3] which is given below:

From the above table we may note that the incidence of color-blindness among males is always higher than that among females. The percentages of the former run from 1.2 to 8.2, while those of the latter run from 0 to 1.25.

The purpose of our investigation is to determine (1) sex differences in the incidence of this defect and (2) the relative

[1] For a good summary one may consult Collins, M: Colour-Blindness, Chapter II. (New York: Harcourt, Brace & Co.)

[2] Haupt, I.: The Nela test for color blindness applied to school children, J. Comp. Psychol., 1926, 6, 291–302.

[3] The author wishes to express his indebtedness to Messrs. D. Y. Cheng and F. Tsao for their assistance in this research.

TABLE I

Summary of Estimates of Per Cent of Color Blindness

EXAMINER	YEAR	NUMBER EXAMINED	PER CENT COLOR BLIND	TEST USED
		Males		
Favre	1864	1,196	1.2	Wools
	1873	728	5.7	Wools
	1875	1,050	5.8	Wools
Feri		501 sailors	8.2	Wools
Holmgren	1876	2,220 infantry	2.7	Holmgren
		100 artillery	4.0	Holmgren
		266 railroad employees	4.8	Holmgren
		45,581	3.5	Holmgren
		32,165	3.5	Holmgren
Donders	1877	2,300	6.5	Donders
Daae	1878	205 boys	4.8	Holmgren
Magnus	1879	3,273	3.2	Holmgren
Borthen	1882	423 boys	3.5	Holmgren
Fontenay		5,287	3.6	Holmgren
Cohn	1899	187 soldiers	4.0	Contrast
		25 teachers	4.0	Contrast
		2,429 school boys	4.0	Contrast
Nagel	1898	1,328 school boys	2.6	Farbengleichungs-apparat
		1,420 infantry	3.6	Farbengleichungs-apparat
Jeffries		19,183	4.1	Holmgren
Schmitz		2,215	4.6	Stilling
Haupt	1926	448 school boys	4.2	Nela
von Planta	1928	2,000 school boys	7.95	Anomaloscope & 6 pigment tests

TABLE I—(*Continued*)

EXAMINER	YEAR	NUMBER EXAMINED	PER CENT COLOR BLIND	TEST USED
		Females		
Dase		208	0	Holmgren
Holmgren		7,119	0.26	Holmgren
Magnus		2,216	0.04	Holmgren
Borthen		117	0.08	Holmgren
Fontenay		3,663	0.43	Holmgren
Cohn		297	1.00	Contrast
		1,061	0.00	Contrast
Dor		611	0.82	
Minder		3,244 school girls	0.27	
Jeffries		14,764	0.07	Holmgren
Schmitz		1,485	0.33	Stilling
Haupt		487 school girls	1.25	Nela
von Planta		3,000 school girls	0.43	Anomaloscope & 6 pigment tests

frequencies of various forms of color-blindness. It has been pointed out by Seebeck, Donders, Rayleigh, Nagel and many others that color sensitivity probably displays a gradual transition from extreme chromatic sensitivity to complete color-blindness. Therefore the usual dichotomy of normal vision and color-blindness presents only an oversimplified picture of the situation.

The apparatus used in this study is the Ishihara test, which has been found by von Planta[3] to be the best of all the six pigment tests that he used as it apparently detects all forms of color-blindness. Moreover, owing to the short time required for its administration, this test is highly suitable for group experimentation.

Our subjects include 305 boys and 11 girls, and range in age from four to fifteen. Most of them belong to middle or higher social strata, but they represent the whole population of the Elementary Department of the Experimental School.

The experiment was conducted in a well-lighted room. Two subjects were tested at a time. They were seated with the back towards the source of light, and had a screen between them, which served as a means of preventing mutual imitation. The experimenter held the test chart erect on the table at a distance of two feet from the subjects, and would not expose the next chart until both subjects had finished copying what they had seen.

The results of this study are given in Tables II and III. Table II gives the relative proportions of normal and anomalous vision. Here we find that the percentages of color-blindness among boys and girls are 5.57 and 0.58 respectively. In Table III are shown the relative frequencies of different forms of color-blindness among these elementary school children. The most striking feature of this table is the absence, among the female sex, of any defect other than that of incomplete total color-blindness.

[3] Von Planta, P.: Die Häufigkeit der angeborenen Farbensinnstörungen bei Knaben und Mädchen und ihre Feststellung durch die üblichen klinischen Proben, Graefes Arch. f. Ophth, 1928, 120, 253–281.

TABLE II

The Incidence of Color-Blindness

AGE \ TYPE / SEX		N	NORMAL	PER CENT	COLOR-BLIND	PER CENT
4	M	5	5	100.00	0	0.00
	F	1	1	100.00	0	0.00
5	M	12	11	91.67	1	8.33
	F	10	10	100.00	0	0.00
6	M	30	29	96.67	1	3.33
	F	17	16	94.12	1	5.88
7	M	34	32	94.12	2	5.88
	F	19	19	100.00	0	0.00
8	M	30	30	100.00	0	0.00
	F	24	24	100.00	0	0.00
9	M	40	39	97.50	1	2.50
	F	20	20	100.00	0	0.00
10	M	40	36	90.00	4	10.00
	F	20	20	100.00	0	0.00
11	M	43	38	88.37	5	11.63
	F	25	25	100.00	0	0.00
12	M	28	28	100.00	0	0.00
	F	14	14	100.00	0	0.00
13	M	26	24	92.31	2	7.69
	F	11	11	100.00	0	0.00
14	M	13	12	92.31	1	7.69
	F	8	8	100.00	0	0.00
15	M	4	4	100.00	0	0.00
	F	2	2	100.00	0	0.00
Total	M	305	288	94.43	17	5.57
	F	171	171	99.42	1	0.58

In this connection we might mention both the study of Chang[4] and that of Kilborn and Beh,[5] the results of which, if combined, will give 6.5 per cent for Chinese males and 1.7 per

[4] Chang, S. P.: Statistics on color blindness among students in Peiping, National M. J. China, 1932, 18, 806.

[5] Kilborn, L. G., & Beh, Y. T.; The incidence of color blindness among the Chinese, Science, 1934, 79, 34.

TABLE III
Different Forms of Color-Blindness

AGE	FORM / SEX	INCOMPLETE TOTAL COLOR BLIND	PER CENT	INCOMPLETE RED-GREEN BLIND	PER CENT	COMPLETE RED BLIND	PER CENT	COMPLETE GREEN BLIND	PER CENT
4	M	0	0.00	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
5	M	1	8.33	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
6	M	0	0.00	1	3.33	0	0.00	0	0.00
	F	1	5.88	0	0.00	0	0.00	0	0.00
7	M	1	2.94	0	0.00	1	2.94	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
8	M	0	0.00	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
9	M	0	0.00	1	2.50	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
10	M	1	2.50	0	0.00	1	2.50	2	5.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
11	M	1	2.33	1	2.33	2	4.65	1	2.33
	F	0	0.00	0	0.00	0	0.00	0	0.00
12	M	0	0.00	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
13	M	1	3.85	1	3.85	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
14	M	0	0.00	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
15	M	0	0.00	0	0.00	0	0.00	0	0.00
	F	0	0.00	0	0.00	0	0.00	0	0.00
Total	M	5	1.64	5	1.64	4	1.31	3	0.98
	F	1	0.58	0	0.00	0	0.00	0	0.00

cent for Chinese females. These figures are much higher than those reported here.

STUDIES OF TYPOGRAPHICAL FACTORS INFLUENCING SPEED OF READING

XI. RÔLE OF SET IN TYPOGRAPHICAL STUDIES*

MILES A. TINKER AND DONALD G. PATERSON
University of Minnesota

SEVERAL psychologists who have reviewed the evidence secured in our series of studies on typography have been disturbed by the fact that, generally speaking, our subjects tend to make lower scores on Form B of the Chapman-Cook Speed of Reading Tests than on Form A. We presented ample evidence that Forms A and B are equivalent in difficulty when printed alike and B follows A.[1] Hence, we concluded that lower mean scores in B must be attributed to typographical variations introduced in Form B as compared with the standard arrangement in Form A (Scotch Roman, 10 point, 19 pica line width, set solid). In spite of this evidence, critics have suggested that "mental set" may be responsible, in part, for the lower scores in Form B. In other words, the "set" developed in reading the standard Form A arrangement is disturbed when subjects are required to shift to a changed typography in Form B. Thus, critics assert

* The writers are indebted to the following for aid in conducting this study: Educational Test Bureau, Minneapolis, Minn., for permission to reprint the Chapman-Cook Speed of Reading Tests, Forms A and B, for experimental purposes; the University of Minnesota Graduate School for research grant; and the Department of English at the College of St. Catherine, St. Paul, and the Department of Engineering English at the University of Minnesota for permission to test students in their freshman English classes.

[1] See Studies of Typographical Factors Influencing Speed of Reading by the writers printed in the JOURNAL OF APPLIED PSYCHOLOGY, especially: I. Influence of Type Form, 1928, 12, 359–368; II. Size of Type, 1929, 13, 120–130; IV. Influence of Practice on Equivalence of Test Forms, 1930, 14, 211–217.

that the lower scores in Form B may be due either to less effective typography or to "set" or to both. The validity of our conclusions concerning various typographical factors so far investigated will remain in doubt until adequate evidence can be adduced to demonstrate that "set" has not been operative in producing the obtained differences in speed of reading.

The present study attempts to measure the influence of this hypothetical factor of "set" and at the same time affords an opportunity to verify, through repetition, our previous result showing that Cloister Black (Old English type) is read 16.5 per cent more slowly than the standard, Scotch Roman.[2] The former study required the subjects to read Scotch Roman type in Form A and then to read Cloister Black in Form B. The present study reversed the order, requiring the subject to read Cloister Black in Form A and then to read Scotch Roman in Form B. In both studies a control group was employed: in the former study Forms A and B were set up in Scotch Roman; in the present study Forms A and B were set up in Cloister Black. If the 16.5 per cent loss in speed of reading Cloister Black as compared with Scotch Roman fails to be confirmed in the present study then presumably the former difference must be attributed in part to "set." On the other hand, if approximately the same loss is disclosed in the present study in spite of the reversal in order of presentation, then the difference found in both instances must be attributed to type face and not to "set."

RESULTS

Table I presents the detailed data for the two comparisons, namely the control group and the experimental group. Results for Test Group I show that the two forms are equivalent even though both are printed in Cloister Black. In other words, equivalence in difficulty of Forms A and B is again established and presumably would prevail for other typo-

[2] X. Style of Type Face, JOURNAL OF APPLIED PSYCHOLOGY, 1932, 16, 605–613.

TABLE I

Cloister Black or Old English vs. Scotch Roman

Differences given are for the mean score on Form A, 10 point, 19 pica line width, set solid, Cloister Black minus the mean score on Form B, 10 point, 19 pica line width, set solid, but varying with respect to style of type face as indicated in column 2. All test forms were printed on egg shell paper stock. The mean score is the average number of paragraphs of 30 words each in the Chapman-Cook Speed of Reading Tests read in 1¼ minutes. In each test group, N = 100 college students in freshman English courses.

TEST GROUP	TEST FORM & TYPE FACE	MEAN	$P.E._{dist.}$	$P.E._M$	DIFFERENCES BETWEEN MEANS IN		$P.E._{diff.}$*	$\frac{D}{P.E._{diff.}}$
					Paragraphs	Percent		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I	A, Cloister Black	14.00	2.62	.26	−0.29	2.01	.12	2.44
	B, Cloister Black	14.29	2.46	.25				
II	A, Cloister Black	13.88	2.39	.24	−2.64	19.02	.16	17.04
	B, Scotch Roman	16.52	2.64	.27				

* $P.E._{diff.}$ values in column 8 were computed on the basis of the standard formula for correlated measures. The *r's* for the test groups were: 0.89 ± .01 for Group I; 0.82 ± .02 for Group II.

graphical arrangements. The crucial comparison for Test Group II shows that Scotch Roman is read 19.02 per cent faster than Cloister Black. To make this value comparable to that reported in our former study it is necessary to report the extent to which Cloister Black retards speed of reading. This may be done by dividing 2.64 by 16.52 which yields a percentage difference of 15.98. The former study showed that Cloister Black in comparison with Scotch Roman retards reading 16.5 per cent. Both studies are in remarkable agreement!

DISCUSSION

In our previous studies, typographical departures from the standard printing arrangement of 10 point, 19 pica line width, Scotch Roman, set solid, have shown a retarding influence on speed of reading with the exception of the study of leading or space between lines.[3] The argument that the trend of available evidence reflects the influence of "set" as well as the influence of typographical factors would appear to be without foundation. In the present study, Form B is read faster than Form A, a finding which directly controverts the hypothetical effect of "set." Thus, our methodology measures the influence of typographical factors in a straightforward manner. Furthermore, the method yields comparable results whether the optimal printing arrangement is presented in Form A or in Form B.

SUMMARY

1. The present investigation was undertaken to discover whether the tendency for subjects to read Form B more slowly than Form A in our previous studies was due to typographical variations alone or in part to a factor of "set."

2. Cloister Black (Old English) was employed as the standard in Form A of the Chapman-Cook Speed of Reading

[3] VIII. Space between Lines or Leading, JOURNAL OF APPLIED PSYCHOLOGY, 1932, 16, 388–397.

Tests and Scotch Roman was introduced as the experimental variable in Form B. Two groups (control and experimental) of 100 college students each were tested.

3. Using Cloister Black as the standard does not affect the equivalence in difficulty of Forms A and B. Presumably equivalence would hold for other typographical arrangements as well.

4. Cloister Black in comparison with Scotch Roman was found to retard speed of reading 15.98 per cent. In a previous study, in which Scotch Roman was utilized as the standard, Cloister Black was found to retard speed of reading 16.5 per cent. Thus, two contrasting methods of presentation yield approximately the same result.

5. The foregoing findings appear to eliminate the factor of "set" as an influence in producing differences obtained when variations in typography are introduced. Hence, the validity of previous interpretations of obtained differences as being primarily due to changes in typography would seem to be established with greater certainty.

AN EXPERIMENTAL STUDY OF THE APPROPRIATENESS OF COLOR AND TYPE IN ADVERTISING

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PROBLEM

ADVERTISING is one of the most important fields to which psychology has been applied. As Hollingworth (3) has pointed out, the effectiveness of an advertisement depends greatly on the feeling tone. Since type faces and color combinations are two of the most important factors in the composition of an advertisement, their suitability affects the pleasantness of the advertisement to a great extent. The present experiment was conducted for the purpose of investigating the appropriateness of certain type faces and color combinations in advertising and to see what bearing the results have upon those of previous investigators.

PREVIOUS STUDIES

Thus far only two experiments have been performed to investigate the appropriateness of type faces, the first by Berliner (1) in 1920 and the second by Poffenberger and Franken (4) in 1923. The former used the order of merit method to measure the relative suitability of 18 different styles of handlettered type for four commodities. From her results Berliner maintained that it is possible to classify commodities in accordance with their feeling tone and that the style of type can be chosen for its appropriateness to an entire group and will, therefore, be suitable for every commodity within that group. Much more important to our investigation, however, was the study made by Poffenberger

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and Franken. Their material consisted of 29 type faces which were ranked by the subjects in order of suitability for five commodities and five abstract qualities. Their conclusion, which is most vital to the present experiment, is that there is considerable variability in the appropriateness of type faces and that this appropriateness can be felt. They give two possible explanations for this: first, that type faces may acquire a certain atmosphere from their size, the heaviness or blackness of the lines, their shape and spacing; and second, that the atmophere may be greatly influenced by the ease with which we can read a word.

The fact that color, too, is important in advertising has been brought out in several studies. The experiment which has most bearing on the present investigation was performed by N. T. Collins (2) in 1924. Her subjects were presented with a list of 10 commodities and 10 abstract qualities and intructed to choose from a set of 20 color combinations that one which seemed to convey best the atmosphere or meaning of each word. Her results indicated that the choices tend to fall within a group of two or three combinations rather than to center about just one. There is a definite relationship between preferences in the different categories, such as between luxury and jewelry, and these are fairly permanent.

MATERIAL

For the first part of the experiment the following 15 type faces were selected so that a varied assortment was obtained:

1. Bernhard Cursive, 36 point
2. Bernhard Cursive Bold, 36 point
3. Broadway, 36 point
4. Caslon no. 471 Italic, 36 point
5. Caslon Text, 36 point
6. Cheltenham Old Style, 36 point
7. Cheltenham Bold, 36 point
8. Clear-Cut Initials, 36 point
9. Eve, 24 point
10. Futura Black, 30 point
11. Goudy, 36 point

12. Parisian, 36 point
13. Scotch Roman, 36 point
14. Washington Text Shaded, 30 point
15. Heavy Gothic, 8 point

The same list of abstract qualities and commodities that Poffenberger and Franken used was presented:

Abstract Qualities	*Commodities*
Cheapness	Automobiles
Dignity	Building Material
Economy	Coffee
Luxury	Jewelry
Strength	Perfume

In the second part of the experiment the subjects were given 20 pairs of color combinations cut from colored paper and placed on a background of neutral grey. The amounts of the two colors used in each design were equated. Saturation differences were not taken into account, but most of the colors were of moderate saturation. The colors were chosen so as to be as similar as possible to those used in modern advertising.

1. Yellow and Green
2. Orange and Blue
3. Red and Black
4. Silver and Black
5. Red and Blue
6. Green and Blue
7. Yellow and Orange
8. Black and Green
9. Red and Purple
10. Silver and Blue
11. Orange and Red
12. Yellow and Purple
13. Red and Green
14. Purple and Silver
15. Red and Yellow
16. Silver and Green
17. Yellow and Black
18. Silver and Red
19. Orange and Green
20. Yellow and Blue

The list of words varied slightly from that in the first part of the experiment. Strength, building material and jewelry were omitted and cleanliness, breakfast food, and soap were added.

SUBJECTS

The subjects in the present study were 20 women students in psychology at Barnard College who were practiced in subjective report.

PROCEDURE

In the first part the type faces were presented, always in the same order, to each subject and they were instructed to rank them in order of appropriateness for each of the 10 words, one word being given at a sitting. The part of the experiment on color combinations, done in the same way, was alternated with the categories in the first part. This, together with the fact that the rankings were spread over a period of two weeks to allow a lapse of time between presentations, probably ruled out any factor of memory.

RESULTS AND INTERPRETATIONS

The first part of our experiment was essentially a repetition of Poffenberger and Franken's. The method used was similar so that direct comparisons could be made in spite of the difference in type faces. In general many differences in the results may be explained by differences in the procedure and limitations of the present experiment as regards number of subjects.

In Table I are presented the rankings obtained by each type face in respect to its appropriateness for each of the five commodities and five abstract qualities. A rank of 1 indicates that the type was most appropriate for the word and 15 least appropriate. There are a number of interesting results. There is a great similarity among the positions assigned to the different types for "luxury," "perfume," and "jewelry." Types such as 3 and 7 which are inappropriate for these categories are excellent for "building material," "strength" and "cheapness." In cases where the type faces are similar to those used by Poffenberger and Franken similarities were found even though the type faces as a whole varied so much in the two studies that the ranks given to the different samples, even where the samples are similar, are apt to differ widely.

The specificity of the atmosphere of type faces is most clearly indicated in the intercorrelations among the different categories which appear in Table II. It is unfortunate that

TABLE I

Rankings in Appropriateness for Different Type Faces

CATEGORY	TYPE FACES														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cheapness	14	11	3.5	8	12	2	1	13	10	5	6	9	3.5	15	7
Dignity	3	4	15	6	2	8.5	14	12	7	8.5	10	5	11	1	13
Luxury	1	3	14	7.5	6	10	15	4	7.5	9	11	5	12	2	13
Strength	14	11	2	10	7	6	1	15	13	3	5	9	4	8	12
Economy	11	9	8	10	13	3	6	14	15	7	1	3	3	12	5
Automobiles	10	7.5	9	1	13	2	7.5	15	11	6	5	4	3	12	14
Coffee	9	11	8	6	13	2	5	15	10	7	1	3	4	12	14
Perfume	1	2	15	6	9	8	14	7	3	13	10	4	12	5	11
Jewelry	1	2	15	6	7	10	14	8	3	13	9	5	12	4	11
Building Mat.	15	10	2	8	9	6	1	14	13	4	5	7	3	12	11

TABLE II

Intercorrelation of Qualities and Appropriateness for Commodities: Type Faces*

		1	2	3	4	5	6	7	8	9	10
Cheapness	1	.....	−.79 ± .059	+.70 ± .08	−.89 ± .03	+.75 ± .07	+.57 ± .11	+.87 ± .04	+.66 ± .09	−.79 ± .06	−.75 ± .07
Dignity	2			−.26 ± .15	+.93 ± .02	−.35 ± .14	−.02 ± .16	−.53 ± .11	−.25 ± .15	+.82 ± .05	+.76 ± .07
Economy	3			.....	−.55 ± .11	+.54 ± .11	+.76 ± .07	+.67 ± .09	+.76 ± .07	−.48 ± .12	−.42 ± .13
Luxury	4				.....	−.66 ± .09	−.23 ± .15	−.77 ± .06	−.39 ± .13	+.89 ± .03	+.80 ± .06
Strength	5					.....	+.69 ± .08	+.94 ± .02	+.57 ± .11	−.75 ± .07	−.79 ± .06
Automobiles	6						.....	+.59 ± .10	+.89 ± .03	−.14 ± .15	−.07 ± .16
Building Material	7							.....	+.67 ± .09	−.81 ± .05	−.44 ± .13
Coffee	8								.....	−.05 ± .16	−.21 ± .15
Jewelry	9									.....	+.98 ± .01
Perfume	10										.....

* Spearman rank difference method.

we were so limited in the number of our subjects that we could not use different groups for each category. However, as has been pointed out, the factor of memory probably played a negligible part. A comparison with the study of Poffenberger and Franken reveals a striking agreement between the two studies. It is only in relation to two categories that any important differences are to be found. Poffenberger and Franken reported a fairly high positive correlation between "cheapness" and "automobiles" while that between "economy" and "automobiles" was much lower. In the present experiment the reverse was true. Moreover, with respect to "luxury" and "automobiles," Poffenberger and Franken found a very high negative correlation while in our investigation the corresponding coefficient was much lower. Insofar as our correlations represent true relationships, they may be interpreted in the light of present-day conditions. It is more than ten years since the previous investigation was performed. Since then there have been many changes in automobile trends. There is more competition in the field and the demands of the consumer are being increased. People no longer want cheapness in an automobile, for they realize that in the long run economy is more profitable. And now we are beginning to see also that there is a demand for luxury in an automobile. It is at least a less unimportant factor than it was before, although economy is still more important. If the trend continues thus, in a few years we may predict a positive correlation between "luxury" and "automobiles." As we shall see, our results for color combinations already show this although the situation is different there. A similar trend is found in the case of "coffee" in its correlations with "cheapness," "economy" and "luxury." This change may have been effected in part by the prevalence of radio advertising for coffee. We must admit the possibility that advertising has caused these changes. The important thing, however, is the fact that shifts in values come with time and should be investigated by advertising.

TABLE III

Rankings in Appropriateness for Different Color Combinations

CATEGORY	YELLOW AND GREEN	ORANGE AND BLUE	RED AND BLACK	SILVER AND BLACK	RED AND BLUE	GREEN AND BLUE	YELLOW AND ORANGE	BLACK AND GREEN	RED AND PURPLE	SILVER AND BLUE	ORANGE AND RED	YELLOW AND PURPLE	RED AND GREEN	PURPLE AND SILVER	RED AND YELLOW	SILVER AND GREEN	YELLOW AND BLACK	SILVER AND RED	ORANGE AND GREEN	YELLOW AND BLUE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cheapness	12	5	13	20	2.5	8	9	14	2.5	18	1	11	6	10	7	17	15	16	4	10
Dignity	15	17	5	1	13	11	19	6	12	3	20	9	16	2	14	8	7	4	18	10
Luxury	12	19	8	1	14	13	18	7	15	3	20	9	16	2	11	5	6	4	17	10
Cleanliness	1	13	19	15	16	10.5	3	14	20	4	18	8.5	17	10.5	6	5	8.5	7	12	2
Economy	1	11	15	20	12	3	7	8	13	17	10	14	4	19	2	16	9	18	6	5
Automobiles	10	17	3	1	12	11	16	5	19	2	20	14	15	8	13	7	4	6	18	9
Coffee	11	2	4	14	9	16	6	8	17	18	5	13	10	20	3	19	1	15	7	12
Perfume	7	16	11	2	19	13	12	9	18	3	20	8	17	4	14	1	5	6	15	10
Soap	1	12	20	18	16	10	2	13	19	8	15	5	11	17	4	9	6	14	7	3
Breakfast Food	1	5	19	20	14	9	2	15	17	16	12	7	10.5	18	4	10.5	8	13	6	3

The second half of our study represented an attempt to check the previous work of Collins (2). In some cases changes were made which would cause differences in the results. Black and Silver were introduced in various combinations because of their prevalence in modern advertising. Omitting the duplication of colors in weak and saturated form as in the study of Collins, the total number of combinations was 20. A number of the words used by Collins were omitted since the experiment did not permit of such detail. However, because of their importance in advertising, "cheapness" and "automobiles" were added to the list.

Table III shows the ranking given to each color combination for the 10 categories. As there were 20 combinations in all, a rank of 1 indicates the highest degree of appropriateness for the particular feeling tone in question and a rank of 20 represents the lowest. In general the results are as would be expected. Combinations such as Yellow and Green are high for "economy," "cleanliness," "soap" and "breakfast food," while those with silver are high for "luxury," "perfume" and "dignity."

From Table IV a comparison between the categories of the present study and those of Collins which are the same is

TABLE IV
The Most Appropriate Color Combinations

CATEGORY	COLLINS		SCHILLER	
	First Choice	Second Choice	First Choice	Second Choice
Dignity	*Y & O	Y & P	S & Bk	S & P
Economy	*Y & O	*B & Y *R & Y	Y & G	R & Y
Luxury	Y & P	R & P	S & Bk	S & P
Cleanliness	B & Y	Y & G	Y & G	B & Y
Breakfast Food	Y & O	Y & G	Y & G	Y & O
Coffee	*Y & O	*R & Y	Yb & Bk	B & O
Soap	Y & G	Y & B	Y & G	Y & O
Perfume	*Y & P	Y & P	S & G	S & Bk

* = weak.

rendered possible. At first glance they do not seem to be very similar for "soap" is the only category in which they agree on first choice. However, a closer examination reveals other facts. In the case of "cleanliness" and "breakfast food" the first and second choices in the two studies are reversed. "Economy" gives a striking preference to yellow combinations in both studies. In the other four categories the differences arise from the inclusion of black and silver in the present study. If these are excluded a closer comparison can be made. Table III shows us that for "coffee" our first two choices would be just the same as those of Collins. For "dignity" our first choice would be Yellow and Purple which is her second, while for "luxury" this combination is first in both studies. In the case of "perfume" the present study would then give Yellow and Green first choice and Yellow and Purple second. So in every single category the two studies are found to be strikingly similar.

Table V gives the intercorrelations among the different categories. No comparison can be made here with Collins' results as she did not present correlations. Most of our results seem to be in line with expectations. The most interesting point is the decided negative correlation between "cheapness" and "automobiles" and the high positive correlation between "luxury" and "automobiles." We have here the same trend observed in the type faces but to a greater degree. This is probably due to the combinations with silver and black, because it is obvious that they would be appropriate for both "luxury" and "automobiles." If they had been omitted the correlations would probably have been nearer those of type faces and the trend would not have been quite as extreme as it seems to be at first glance here.

CONCLUSIONS

With regard to type faces the present investigation seems to point to the following conclusions:

1. Type faces have been found to vary in appropriateness for different uses. As Poffenberger and Franken point out,

TABLE V

Intercorrelation of Qualities and Appropriateness for Commodities: Color Combinations*

		1	2	3	4	5	6	7	8	9	10
Cheapness	1	.....	−.85 ± .04	.54 ± .11	−.76 ± .07	−.39 ± .13	−.90 ± .03	.35 ± .14	.43 ± .13	−.01 ± .16	−.95 ± .02
Dignity	2			−.68 ± .08	.96 ± .01	.20 ± .15	.87 ± .04	−.46 ± .12	−.68 ± .08	−.34 ± .14	.78 ± .06
Economy	3			.....	−.60 ± .1	.29 ± .14	−.43 ± .13	.73 ± .07	.44 ± .13	.62 ± .10	−.47 ± .12
Luxury	4				.....	.27 ± .15	.89 ± .03	−.45 ± .13	−.44 ± .13	−.16 ± .15	.76 ± .07
Cleanliness	5					.....	.23 ± .15	.73 ± .07	−.03 ± .16	.83 ± .05	.50 ± .12
Automobiles	6							−.29 ± .14	−.24 ± .15	−.13 ± .16	.80 ± .06
Breakfast Food	7						.....	.....	.39 ± .13	.89 ± .03	−.19 ± .15
Coffee	8								.....	.27 ± .15	−.42 ± .13
Soap	9									.....	.02 ± .16
Perfume	10										.....

* Spearman rank difference method.

this is a factor that should not be overlooked even though it is only one among many others, for every little detail builds up the general feeling tone of the advertisement.

2. This experiment, as well as the preceding work in the field, has shown that the appropriateness of type faces can be subjectively determined by a group of observers and thus can be ascertained before an advertisement is constructed. Above all, the judgment of one person is not enough, but a random sampling of the population to be reached should be used to rule out personal idiosyncrasies.

3. In general our results bear out those of Poffenberger and Franken. Most of the differences are slight and may be partially attributed to the smaller number of subjects and to differences in the type faces in the present study. The only important differences were in the categories of "automobiles" and "coffee." We offer an interpretation of these changes in terms of a shift in values. Today there is more stress on "economy" than "cheapness," and "luxury" is also becoming more important with the increase in competition.

4. The reasons for the differences in appropriateness of type faces are undoubtedly those offered by Poffenberger and Franken. In the first place, the type faces themselves carry a certain atmosphere according to their structure and shape. Secondly, the atmosphere may be due to past use and the association thus built up.

With regard to color combinations we derive the following conclusions:

1. Color combinations vary in appropriateness depending on the use to which they are put.

2. Here, as well as with type faces, the appropriateness can be subjectively determined, and a consensus of opinion should be used to rule out individual differences.

3. When the combinations which contain black and silver are omitted there is good agreement with the previous work of Collins.

4. Past association is probably the most vital factor here,

although the intrinsic pleasantness or unpleasantness of the separate colors also has an influence. Uniqueness and distinction are important in advertising and for this reason new and different shades of color are constantly being used. Therefore, it is essential to see that they are pleasant and in harmony with the desired feeling tone.

SUMMARY

The present study represents an attempt to investigate the appropriateness of certain type faces and color combinations in advertising and to determine what bearing the results have upon those of previous investigators. The material consisted of 15 type faces and 20 color combinations which were ranked in order of appropriateness for each of five commodities and five abstract qualities by a group of 20 women psychology students who were practiced in subjective report. The results show clearly that both type faces and color combinations vary in appropriateness depending on the use to which they are put. It is possible to determine this appropriateness subjectively by the use of the consensus of opinion of a random sampling of the population to be reached by the advertisement. In general, our results bear out the previous work in the field, but such changes as there are show clearly the necessity for advertising to keep pace with the changing demands and needs of the consumer.

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THE "RECOGNITION SPANS" OF "GOOD" AND "POOR" READERS: A COMPARATIVE STUDY

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I. THE GENERAL PROBLEM

THE search for convenient dependable criteria of reading ability is still inviting—even though at least two very satisfactory general criteria, namely, *speed* and *comprehension*, are already well established.[1] Often it is desirable to supplement the usual tests—sometimes just for purposes of verification and then again mainly for purposes of further analysis.[2] Besides in some cases it is practically necessary to approach the analysis from as many angles as possible.[3]

Moreover, the most attractive possibility in this connection is the *recognition span*—or at least so it would seem. This *span* at least apparently includes or represents in a large measure the *attention span*, the *perception span*, and the *memory span*. Also, presumably it represents the normal *unit of association*. Then too, this factor is readily measureable—its spatial aspect by means of the tachistoscope and its temporal aspect by means of the chronoscope.

Indeed, the fact is that a considerable amount of experimental data are already available on different aspects of the recognition span.[4] The results of most of the studies bearing on the spatial and temporal aspects of attention, perception,

[1] Nearly all of the most generally used reading tests are designed to measure reading ability in terms of speed and comprehension.

[2] *Cf.* Arthur, Grace. An Attempt to Sort Children with Specific Reading Disability from Other Non-Readers, *Journal of Applied Psychology*, 11, 1927, 251–263.

[3] *Cf.* Blanchard, Phillis. Reading Disabilities in Relation to Maladjustment, *Mental Hygiene*, 12, 1928, 772–788.

[4] The investigational literature in this field is reviewed regularly by W. S. Gray. See his summaries in *The Elementary School Journal*.

and memory[5] are at least suggestive of significant differences in the traits involved. Pyle's study on the reading span[6] has direct bearing: his results indicate very clearly that the number of words that can be grasped in a three-second exposure of reading material may be serviceable as a means of determining the extent to which an individual has made progress in learning to read. Also, all of the large amount of work that has been done in the analysis of eye movements in reading[7] is pertinent. The number of fixations per line, the regularity of the movements, and the duration of the pauses may actually represent particular aspects of the normal associative unit.

II. AN EXPERIMENTAL ATTEMPT TO TEST THE VALIDITY OF THE RECOGNITION SPAN

In an attempt to test the recognition span as a possible criterion of reading ability, a group of "good" readers was compared with a group of "poor" readers—first as to their average reaction times to words and phrases of different letter- and word-lengths, and then again as to their word- and phrase-recognition times and their apparently normal associative units.

The two groups of readers were selected on the basis of scores made on a battery of standard reading tests. The *Detroit Word Recognition Test* (*Form A*), the *Detroit Reading Test* (*Test 2; Form A*), and the *Haggerty Reading Examination* (*Sigma 1*) were given to a class of forty-four third grade pupils.[8] The five pupils who made the best showing on all three of the tests were chosen as the "good" reader

[5] *Cf.* Tinker, Miles A. Visual Apprehension and Perception in Reading, *Psychological Bulletin*, 26, 1929, 223–240.

[6] Pyle, W. H. The Reading Span, *The Elementary School Journal*, 29, 1928–29, 597–602.

[7] *Cf.* Tinker, Miles A. Eye Movement Duration, Pause Duration, and Reading Time, *Psychological Review*, 35, 1928, 385–397.

[8] The experiment was done in Morton School, West Lafayette, Indiana. Superintendent F. A. Burtsfield kindly cooperated in the project.

group; and the five who stood lowest were chosen as the "poor" reader group. Almost uniformly the pupils in the "good" reader group stood above the Q_3 point in the distributions for different tests; and likewise those in the "poor" reader group tended to fall below the Q_1 point in the different distributions.

The reaction times for the two groups were determined by means of the *Marietta Reaction Time Set*. To begin with, all of the pupils in each case were given a training series in reaction to simple visual stimuli. Then, they were given a second training series—this time in reaction to words of different letter-length. And finally, the test series consisting of words of different letter-length and phrases of different word-length were presented.

In the first training series reactions were required over and over again, to a blank white card as the stimulus-object. This exercise was done primarily to show the pupils (individually, of course) how the apparatus was operated and to establish the appropriate mental sets. But along toward the close of this series thirty measures were obtained for each pupil, so that the two groups could be compared as to average simple reaction time.

The purpose of the second training series was: (1) to carry the first training series one step further and adjust the pupils to the experimental situation when printed material served as the stimulus-object; and (2) to determine the extent to which extreme familiarity with the material presented might influence the average reaction times of the two groups. Accordingly, the following series of words was presented over and over again (in haphazard order) until each pupil had responded ten times to each word.

The reaction times for the different groups of words and for each of the two groups of readers were dealt with just as though only one word and one subject or observer had been used in each case.

THE WORDS FOR THE SECOND TRAINING SERIES

Three-letter	Four-letter	Five-letter	Six-letter
joy	moon	eight	yellow
red	girl	table	butter
man	baby	child	eating

The test series consisted of three-, four-, five-, six-, and seven-letter words and three-, four-, five-, six-, seven-, and eight-word phrases, taken mainly from the *Detroit Word Recognition Test*.[9]

THE TEST SERIES

Words

Three-letter	Four-letter	Five-letter	Six-letter	Seven-letter
dog	bird	apple	bitter	thirsty
boy	door	bread	street	working
bed	blue	chair	mother	
	tree			
	king			
	fire			

Phrases

Three-word	Four-word	Five-word
a white horse	a bird eating corn	a mother making a bed
a black horse		a house on a hill
a bird sleeping		some leaves under a tree
a bird's house		some apples on the ground
a mother bear		some apples on a tree
a father bear		some leaves on a tree
three little balls		
two big balls		

[9] This material was used and is here reproduced by permission of the World Book Company, publishers of the test involved.

Six-word	Seven-word	Eight-word
a girl running up a hill	a boy with some bread and milk	a father telling his little girl to come
a girl running down a hill	a boy buying a can of corn	
a girl running into a house	a girl giving her bird some water	
a boy going for a walk	a bird singing to her little ones	
a bird flying over a tree		
a boy playing in the rain		

The words and the phrases included in this series were presented separately. That is, the words were presented as a partial series; and then the phrases were presented. In each case the order was a matter of chance. And, in general, the whole series was presented twice.

Here again, the reaction times for each of the different words and phrases were thrown together. A "poor" reader's reaction time was considered as a reaction time for "poor" readers regardless of the particular "poor" reader; and likewise for the reaction times of the "good" readers. Also, the reaction time for a given letter-length word or for a given word-length phrase was considered as a reaction time for words or phrases of the same length. This procedure may have operated to multiply cases unduly; but, since the same thing was done for both groups, the data were accepted as strictly comparable from one group to the other.

In all parts of the experiment, care was exercised in the direction of keeping the conditions as nearly constant as possible. The observers were trained and adjusted to the experimental situation—all in the same way and for the same length of time. The materials were presented under standard conditions of exposure. The observation periods were short, generally from fifteen to twenty minutes in length. And, always, the instruction was to "Press the button (the reaction-key) just as soon

as you can"—"as soon as you see the light (in the case of simple reaction);" "as soon as you know the word (in the case of reaction to words);" and "as soon as you know the words (in the case of the phrases)." As a matter of checking the reactions, the observers were required to call out the words and phrases after each presentation. In case an observer did not know a word or could not call out a phrase correctly, that observer was told the word or the correct statement of the phrase; and later in the series that particular word or phrase was reintroduced as before.

III. THE SENSORI-, THE WORD-, AND THE PHRASE-REACTION TIMES OF "GOOD" AND "POOR" READERS

The different sets of reaction times that were obtained in the experiment just described are presented in the following tables. In each case the data consist of: (1) measures of central tendency and variability in the reaction times, and (2) measures of difference as between the two groups in so far as average reaction time is concerned.

Table I shows the extent to which "good" and "poor" readers tend to differ—(1) as to simple reaction time to visual stimuli, and (2) as to reaction time to words and phrases to which they have responded repeatedly. Here it will be observed that the average simple sensori-reaction time for the "good" reader group is considerably and certainly statistically significantly less, *i.e.*, shorter, than that for the "poor" reader group—a very interesting fact, to say the least. And also it will be observed that the average word-reaction times for the "good" reader group are uniformly much shorter than those for the "poor" reader group. The critical indices (the $\frac{\text{Diff's}}{\text{P.E.}_{\text{diff's}}}$ and the corresponding "chances in 100 of a true difference") point very clearly to the fact that the obtained differences are extremely significant. Statistically considered, a difference is truly significant if it is four times its probable error: and here the differences range from seventeen to twenty-

TABLE I

The Simple Reaction Times and the "Very Familiar Word" Reaction Times of the Two Groups of Readers

GROUPS	MEASURES	SIMPLE REACTION TIMES*	"VERY FAMILIAR WORD" REACTION TIMES			
			Letter-Lengths of the Words			
			3	4	5	6
1. "Good" Readers (N, 5)	N**	150	150	150	150	150
	M	15.28	16.32	16.53	16.88	16.72
	O	3.71	5.85	5.65	6.34	6.05
	$P.E._M$	.36	.32	.31	.34	.33
2. "Poor" Readers (N, 5)	N	150	150	150	150	150
	M	19.84	30.10	28.86	27.91	28.45
	O	4.82	14.35	9.51	9.81	7.32
	$P.E._M$	.46	.74	.51	.54	.40
	$Diff._{in\ M's}$	4.56	13.78	12.33	11.03	11.73
	$P.E._{diff.M's}$	.19	.81	.60	.64	.52
	$\frac{Diff.}{P.E._{diff.}}$	24.00	17.01	20.55	17.23	25.59
	"Chances in 100 of a true difference"	100	100	100	100	100

* The reaction times in both simple and "very familiar word" reactions are given in terms of hundredths of a second.

** See text, Section II, for explanation of the discrepancy between the N's (exposures) used as the basis of calculation and the actual *N's*, *i.e.*, the number of observers.

four times the probable errors. And besides, it is clear from inspection that the word-reaction times for the "good" reader group tend to be only slightly more than one-half as long as the word-reaction times for the "poor" reader group.

In this connection, it perhaps should be pointed out also that the reaction times for the different letter-length (very familiar) words are approximately the same in all cases for the given group of readers. The reaction time for a three-letter word that has been responded to over and over, again and again, is neither significantly shorter nor significantly longer than, for

TABLE II

The "Good" and the "Poor" Readers' Reaction Times to Known But Not Especially Practiced Words and Phrases

GROUPS	MEASURES	"KNOWN WORD" REACTION TIMES* Letter-Lengths of Words					"KNOWN PHRASE" REACTION TIMES Word-Lengths of Phrases†					
		3	4	5	6	7	3	4	5	6	7	8
1. "Good" Readers (N, 5)	N**	24	48	24	8	8	64	8	48	48	32	8
	M	19.67	16.92	18.83	19.63	19.88	19.82	36.75	23.19	22.05	33.15	30.00
	O	3.52	5.19	6.04	6.43	4.05	5.78	17.87	9.39	17.88	17.55	12.87
	$P.E._M$	.48	.49	.83	1.54	.97	.49	4.27	.91	1.74	2.09	3.07
2. "Poor" Readers (N, 5)	N	30	60	30	10	10	80	10	60	60	40	10
	M	34.85	42.06	42.49	44.20	55.40	132.18	218.00	224.92	231.25	334.35	354.30
	O	21.00	24.40	23.59	21.72	20.35	75.75	67.90	81.25	89.50	10.44	88.15
	$P.E._M$	2.63	2.17	2.95	4.64	4.34	5.38	14.16	7.08	7.80	11.14	18.81
	$Diff._{in\ M's}$	15.18	25.14	23.66	24.57	35.52	113.36	281.25	201.73	209.20	301.16	324.30
	$P.E._{diff.\ M's}$	2.67	2.22	3.06	4.89	4.22	5.41	4.69	7.81	7.99	11.30	19.05
	$\frac{Diff.}{P.E._{diff.}}$	5.66	11.95	7.74	5.02	8.42	20.90	59.92	28.51	26.50	26.61	17.00
	"Chances in 100 of a true difference"	100	100	100	100	100	100	100	100	100	100	100

* Same as footnote in Table I.

** Same as footnote in Table I.

† It should be noted here that the phrases, especially the longer ones were not in general presented as a single continuous line, but as two or, in some cases, three partial lines. The phrases were presented just as they are printed in the *Detroit Word Recognition Test.*

example, the reaction time for a six-letter word that has been responded to again and again.

Table II shows: (1) the extent to which "good" and "poor" readers tend to differ in average reaction time to known but not practiced words and phrases, and (2) the extent to which the letter-lengths of such words and the word-lengths of such phrases tend to influence the difference in the reaction times of the two groups. Here, again, it will be observed that the reaction times for the "good" reader group are much less than the reaction times for the "poor" reader group. In this case the word-reaction times for both groups tend to be somewhat longer than the reaction times to practiced words (compare Tables I and II); but when the two groups are compared on the basis of these reaction times it is clear in the present case that the "good" reader group is much the more superior. In general the word-reaction times for this group tend to be considerably less than one-half as long as the word-reaction times for the "poor" reader group.

The phrase-reaction times for the "good" reader group tend to be so much less than the phrase-reaction times for the "poor" reader group that any detailed comparison of the two groups on this basis seems hardly to be in order. The reaction times for the "poor" reader group actually tend to be from five to ten times longer than the reaction times for the "good" reader group.

In the present case (with known but not especially practiced words and phrases used as stimulus-objects), it will be observed also that the letter-length of the words and the word-length of the phrases tend to influence the average reaction times of the two groups. This influence is negligible in the word reactions and only slight in the phrase reactions for the "good" reader group—however, it should be noted that the phrase-reaction times for this group tend to be somewhat longer than the word-reaction times. But, for the "poor" reader group, the influence of the length of the words and the phrases is very pronounced, especially in the phrase reactions. This

group's average reaction time to three-letter words is considerably less than its average reaction times to four-, five-, and six-letter words in which the differences are only slight or negligible. But its reaction time to seven-letter words is significantly greater or longer than its reaction time to even six-, or five-letter words—although it should be pointed out here that the sampling in a few of these cases may not be entirely adequate. And, when it comes to the phrase reactions, this "poor" reader group runs up reaction times that seem out of all proportion. Its average reaction time for three-word phrases is nearly three times its average reaction time to seven-letter words; and its average reaction time for phrases gradually increases with the length of the phrase until the value for eight-word phrases is in the neighborhood of three times the value for three-word phrases.

Also, it should be noted that throughout the comparisons (Table II) the critical indices indicate very clearly that the obtained differences are statistically significant, in spite of the small samplings in some cases.

In general these data, taken together, seem to justify the following conclusions.

1. "Good" and "poor" readers as defined in this study tend to differ greatly in the time it takes them to "recognize and react" to a given sensori-, word-, or phrase-stimulus of the visual type. The times for "good" readers are in general much shorter than the times for "poor" readers. Even in the case of simple visual stimuli, the time for "good" readers tends to be significantly less than it is for "poor" readers. And with words and phrases used as stimuli, the differences in the times for the two types of readers are very pronounced.

2. Familiarity with the stimulus-materials operates to influence the reaction times of both "good" and "poor" readers. In either case it tends to shorten and equate the reaction times for the given type of stimulus-material

(words of different letter-length, for example); and then too, it tends to reduce the differences between the reaction times for the two types of readers.

3. The length of the exposure material (when known but not especially practiced words and phrases are used as stimulus-objects) affects the reaction times of "good" and "poor" readers. In the case of "good" readers the influence is only slight; but in the case of "poor" readers the influence is very marked.

IV. THE RECOGNITION TIMES AND THE NORMAL ASSOCIATIVE UNITS OF "GOOD" AND "POOR" READERS

Word- and phrase-reaction times are complex as to the functions represented. They include, in each case: (1) the time required for the sensory process, (2) the time required for the simple motor performance, and (3) the time required for recognition. Also, the extent to which familiarity with the particular word or phrase is a determining factor, from case to case, is not definitely known.

It is difficult, therefore, to identify the recognition times in such reaction times. But, with simple sensori-reaction times given and with the method of statistical rounding available[10] presumably such determinations are possible. By subtracting the sensori-reaction times from the word- and the phrase-reaction times, the times required for the sensory processes and the motor performances can, at least logically, be ruled out. And, by means of statistical rounding—which procedure operates to statistically multiply cases and attenuate for extraneous factors—the possible variations in the familiarity factor can, at least theoretically, be equated.

Thus, *i.e.*, in the light of these assumptions, consider the data that are presented in Tables III and IV.

These data were derived by calculation. The simple reaction times given in Table I were substracted from the word-

[10] Kelly, Truman L., *Statistical Method* (The Macmillan Company, New York, 1924), p. 27 ff.

TABLE III
The Word-Recognition Times of the Two Groups of Readers

GROUPS	WORDS-LETTER LENGTHS					AVERAGE INCREMENTS
	3	4	5	6	7	
1. "Good" Readers	3.35*	3.39	3.54	3.91	4.21	0.22
2. "Poor" Readers	18.89	19.53	22.61	26.02	29.42	2.63
Diff.	15.54	16.14	19.07	22.11	25.21	2.41

* The recognition times are given in terms of hundredths of a second. See text for the method of derivation.

TABLE IV
The Phrase-Recognition Times of the Two Groups of Readers

GROUPS	PHRASES-WORD LENGTHS						AVERAGE INCREMENTS
	3	4	5	6	7	8	
1. "Good" Readers	10.77*	11.16	11.64	12.33	13.35	14.34	00.71
2. "Poor" Readers	158.39	176.87	208.16	246.01	281.78	304.79	29.28
Diff.	147.62	165.71	196.52	233.68	268.43	290.45	28.37

* Footnote same as in Table III.

and the phrase-reaction times given in Table II. Then the difference values were rounded three times by the method of the moving average (the word- and the phrase-reaction times were dealt with separately, of course).[11] And, it was assumed that the values thus finally obtained were fairly accurate representations of the word- and the phrase-recognition times of the two groups of readers.

The comparisons indicated in Tables III and IV are obvious. Throughout the whole list, the differences favor the "good" reader group. Indeed the differences in the word-reaction times of the two groups are, almost uniformly, approximately five times the corresponding recognition times of the "good" reader group; and in the phrase-recognition times this ratio actually ranges up to better than twenty.

[11] Kelly, *ibid.*, p. 28.

Also, the phrase-recognition times are significantly greater or longer than the word-recognition times. For the "good" reader group the ratio of the phrase-recognition time to the word-recognition time tends to be approximately three. And in the case of the "poor" reader group the phrase-recognition time tends to be approximately ten times the word-recognition time.

Even, the recognition time for a word of a given letter-length tends to be somewhat greater than the recognition time for a word just one letter shorter; and the recognition time for a phrase of a given word-length tends to be considerably greater than the recognition time for a phrase that is just one word shorter—although the extent of the differences indicated here depends very largely on the reader. In the case of "good" readers, the average increase in the word-recognition time for each added letter is approximately two thousandths of a second; and the average increase in the phrase-recognition time for each added word is only seven thousandths of a second. In the case of "poor" readers, each added letter increases the word-recognition time by somewhat more than twenty-six thousandths of a second; and each added word icnreases the phrase-recognition time by approximately two hundred ninety-three thousandths of a second.

Most of these comparisons are definitely observable in Figures 1 and 2. The curves given in these figures are based on the data contained in Tables III and IV. Here it will be seen that the recognition times for "good" readers are practically negligible, as compared with the recognition times for "poor" readers. The curves for the differences between the reaction times of the two groups of readers actually approximate fairly closely the curves for the recognition times of the "poor" readers.

Also, it will be observed in Figures 1 and 2 that the differences between the word- and the phrase-reaction times for "good" readers are not particularly significant. The phrase-recognition times, to be sure, are approximately three times the

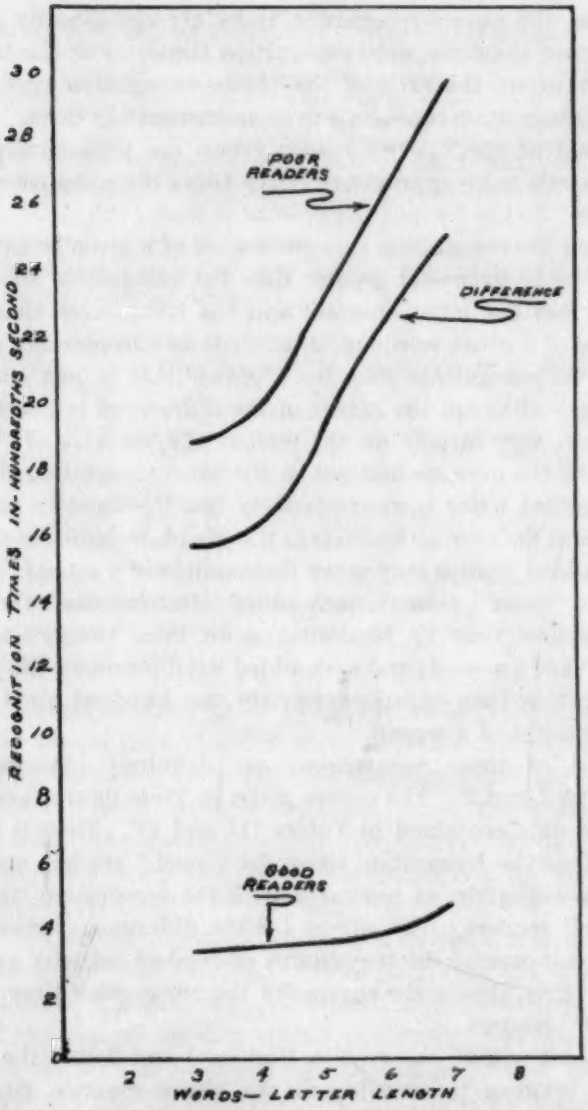

FIG. 1. Curves of Word-Recognition Times (based on the data in Table III).

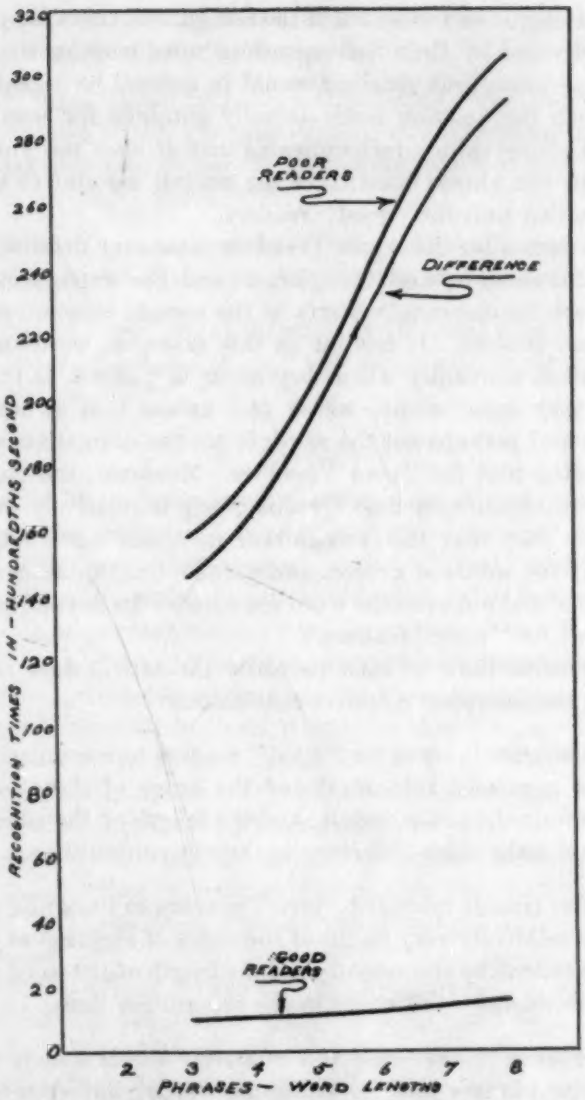

FIG. 2. Curves of Phrase-Recognition Times (based on the data in Table IV).

word-recognition times; but if the recognition times for phrases were divided by their corresponding word-lengths, the word-reaction times thus obtained would in general be considerably less than the reaction times actually obtained for words presented alone—which fact indicates that at least the word and perhaps the phrase constitutes the normal associative unit or the reading unit for "good" readers.

The curves for the "poor" readers show very definitely that the differences between the phrase- and the word-recognition times are fundamental criteria of the normal associative units for such readers. It is clear in this case that words are not recognized as readily when they occur in phrases as they are when they occur alone—which fact means that at least the phrase and perhaps not the word, is not the normal associative or reading unit for "poor" readers. Moreover, the fact that the word-recognition time for this group is relatively so great and the fact that this recognition increases materially and steadily for words of greater and greater length, indicate that the letter and not even the word constitutes the normal associative unit for "poor" readers.

In general these at least partially theoretical data tend to justify the following tentative conclusions.

1. The time it takes for "good" readers to recognize words is relatively very short—of the order of three or four hundredths of a second; and the length of the word does not make much difference in the recognition time.

2. The time it takes for "poor" readers to recognize words is relatively very long—of the order of eighteen to thirty hundredths of a second; and the length of the word makes considerable difference in the recognition time.

3. It takes "good" readers a relatively longer time to recognize phrases than to recognize words; but even so the phrase-recognition times are not directly proportional to the word-recognition times—the recognition time for

words in phrases being, in general, much less than the recognition time for single words.

4. It takes "poor" readers a much longer time to recognize phrases than to recognize words; and the recognition time for words in phrases is, in general, much greater than it is for single words.

5. "Good" readers (at the third grade level) tend to read in terms of words and phrases as associative units.

6. "Poor" readers (at the third grade level) tend to read in terms of letters (to spell out words and phrases as associative units.

V. CONCLUSION

Even word- and phrase-reaction times are at least apparently fairly sound criteria of reading ability. Certainly they are valid for at least rough discriminations. "Good" and "poor" readers can, in general, be distinguished on either basis; and on the basis of phrase-reaction time the overlap from "good" to "poor" readers, and vice versa, is practically negligible.

Word- and phrase-recognition times are obviously valid for rough discriminations; and it may be that they are entirely adequate for fine distinctions. "Good" and "poor" readers are readily distinguishable on the basis of word-recognition time; and on the basis of phrase-recognition time the difference is very great. Indeed, the difference on either basis is so great as to suggest that recognition time is a continuous function in which it is possible to identify significant differences all the way along.

Also, the unit of association—or, in other words, the spatial aspect of the recognition span—is significant as a possible criterion. "Good" readers read in terms of much greater units of reading material than do "poor" readers.

But, of course, it is to be remembered: (1) that the data on which these generalizations are based represent a very limited

range of talent; (2) that, even within the very limited range of talent involved, only the extremes were sampled; (3) that the experimental groups were very small; and (4) that in some cases the number of measures obtained was slight. Further investigation is required. The entire range of reading ability needs to be sampled. Measures of both the temporal and the spatial aspects of the recognition span should be tested by means of the most precise criteria available.

THE INFLUENCE OF SURFACE AND TINT OF PAPER ON THE SPEED OF READING

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THE present investigation was designed to discover the differences in the speed of reading on papers varying in printing surface and color. It was suggested by opinions and assertions generally made by authorities of the graphic arts that legibility is facilitated by using printing stock with a coarse, rough, or antique finish of a moderate "india" or "natural" tint. While this opinion has been recognized generally by the printing industry when planning or producing printed pieces, there have been certain limitations of reproducing illustrations that have forced the trade to use a glossy or coated stock for a large percentage of the work requiring illustrations until the recent development of a dull-coated paper. The present experiment follows a series begun by Miles A. Tinker and Donald G. Paterson, in 1927, on the "Typographical Factors Influencing Speed of Reading," and published for the most part in the *Journal of Applied Psychology*.

Only one reference to similar problems is found in the psychological literature. Rothlein,[2] in her study of the legibility of different type faces did attempt to find the relation be-

[1] The authors acknowledge their indebtedness to the following for assistance in conducting this experiment: the S. D. Warren Company, Boston, Massachusetts, for supplying the paper stock upon which the tests were made; the Educational Test Bureau, Minneapolis, Minnesota, for permission to reprint the Chapman-Cook Speed of Reading Tests, Forms A and B for experimental purposes; and the instructors of the Departments of Psychology of the Ohio State University, Ohio Wesleyan University, and Denison University who made the subjects available.

[2] Rothlein, Barbara, "The Legibility of Different Faces of Printing Types," *American Journal of Psychology*, 1912, *23*, 1–36.

tween legibility and the quality of paper surface. She used groups of letters from nine different type faces printed upon two papers, (a) "white coated book paper" and (b) "very slightly yellowish antique laid book paper." In the conclusion to her study she reports, "The quality and texture of the paper is a much less significant factor than has been supposed."

While no systematic treatment of the problem has been found in the few outstanding, modern books on typography and advertising, nevertheless there are authorities who make recommendations on the matter of paper, surface, and color. W. A. Dwiggins,[3] discussing the specifications for an ideal paper says in regard to the color, "if it is white, it will not be too white, and yet not definitely 'india'; a 'natural' color." Later, when discussing the relative merits of the various papers used in relief printing, he writes, "When a given piece of work is specifically a type job, or type with line plates—when there are no halftones to be used—when bulk does not matter—when a piece of printing does not need to be handled very much—the designer of advertising will specify antique finish. . . . And he will be right; because in all those cases the type is the prime thing, and the paper that gives type the best chance to be read is the paper to use—and antique paper gives type the best chance."

D. B. Updike,[4] as he turns from treating the subject of ink to the discussion of paper surface and color, explains, "Though ink must be black, paper should not always be white. The somewhat irregular Caslon type (and some period and transitional types) appears much more agreeably when printed on a slightly rough paper of a cream tint."

In a book prepared and distributed by the W. B. Conkey Company for their clients,[5] we read, "Paper plays a prominent

[3] Dwiggins, W. A., "Layout in Advertising," Harper and Brothers, New York, 1928.

[4] Updike, D. B., "In the Day's Work," Harvard University Press, Cambridge, Massachusetts, 1924.

[5] "What a Business Man Should Know about Printing and Bookmaking," W. B. Conkey Co., Hammond, Indiana, 1928.

part in type legibility. Type loses color on a glossy-coated stock and gains color on an English Finish paper, and gains color still more on an antique finish paper." In a set of books[6] prepared for users of paper by the S. D. Warren Company, they show the same block of type printed on a complete range of paper surfaces, and say, "This block of type is printed on each sheet. . . to demonstrate that the same kind of type prints differently on papers having different surfaces." On the sample printed on the glossy-coated stock they say, "A background tint adds to type legibility on a coated paper."

These quotations taken from various authors are probably without experimental foundation yet they represent opinions gained from empirical observations over a period of years.

PROCEDURE

The method used by Tinker and Paterson[7] in their studies of legibility was followed in the present investigation. The material comprised Forms A and B of the Chapman-Cook Speed of Reading Tests which were designed to measure rate of reading rather than comprehension. The test was originally used in the elementary grades, with a time limit of 2½ minutes. In the present study and those of Tinker and Paterson with adult subjects, the time was cut to 1¾ minutes so that only rarely could any subject finish the complete forms. The tests are so arranged that they not only give a measure of sheer speed of reading but also a check upon accuracy. In each form there are 30 numbered sections of 30 words each. The sections are grouped in paragraphs of 5 sections each. The center form in Figure 1 indicates the page layout employed on Test Forms A and B in the present experiment. One word in the last part of each section spoils the sense. The subject crosses out that word. This reaction serves as evidence that he has read the section, and also gives a means of scoring the test form. It is impossible to cross out the right word without reading the

[6] "More Business Series," No. 1 and 4, S. D. Warren Co., Boston.

[7] Tinker, M. A., and Paterson, D. G., "Influence of Type Form on Speed of Reading," *Journal of Applied Psychology*, 1928, *12*, 359–368.

section. An understanding of the text is necessary; but because the content was designed for the elementary grades, the element of comprehension is minimized for adults. The vocabulary content is simple, and hence speed of reading is the function measured.

The Chapman-Cook forms proved very successful in the studies by Tinker and Paterson of mechanical factors, such as type face or length of line, influencing the speed of reading. Consequently, these forms were adopted for the present investigation. It is our opinion that these tests more closely resemble actual reading conditions, and therefore are superior in problems such as the present, to other methods which involve legibility of isolated letters or words. In actual practice we do not read in single letters, but in word and phrase patterns. Moreover, Tinker and Paterson determined and standardized approximately optimal conditions for the speed of reading. These conditions were adopted in the present material, viz. the type was set in 10 point Scotch Roman, (inset Figure 1), caps and lower case, 19 picas wide, leaded 2 points. The paper on which the tests were printed measured 8½ by 11 inches.

The extensive studies of Tinker and Paterson established the approximate equivalence of the test forms if presented in the order A–B. The latter was just sufficiently more difficult to nullify the effect of practice. They say, "When a group is subjected to the tests for the first time, Forms A and B yield equivalent average scores."[8] In their later studies, however, Tinker and Paterson have found it helpful in interpretation of the data to run a control group in which all variables are held constant in both forms of the tests. Such a procedure could test the above assumption as to equivalence of forms. A control group was used in the present experiment. The optimal conditions for rapid reading above mentioned, with reference to type face, point, case, and line length, were kept constant for Form

[8] Tinker, M. A., and Paterson, D. G., "Studies of Typographical Factors Influencing the Speed of Reading: IV. Effect of Practice on Equivalence of Test Forms." *Journal of Applied Psychology*, 1930, 14, 211–217.

A and the six sets of Form B. Following the procedure of Tinker and Paterson, Form A was printed on a 17 x 11 sheet folded so as to give 4 pages of 8½ x 11. On page 1 were the necessary directions and preliminary drill. Page 3 carried Form A of the test. Form B which always came second was printed on a single 8½ x 11 sheet using the same page format as Form A.

The test forms were printed on the following stocks:

Form A—Warren's Lustro, White
Form B—Warren's Lustro, White
Form B—Warren's Lustro, Ivory
Form B—Warren's Lustro Brilliant-Dull, White
Form B—Warren's Cameo, Ivory
Form B—Warren's Olde Style Wove, White
Form B—Warren's Olde Style Wove, India

In these stocks three different surfaces are represented, each in a white and an ivory. Lustro is a glossy coated surface, lustro brilliant-dull and cameo are dull coated papers which will nevertheless take good halftones while the olde styles are antique unfinished surfaces. India and ivory are very similar.

Every subject received Form A, Lustro, White, which was the control test. This test on Form A was followed by Form B which was the experimental test, and was printed on six different papers. Every subject received one of the Form B papers. Previous to the testing, the six sets of Form B had been so arranged that only every sixth paper was identical, thereby assuring a random distribution of forms in which such factors as illumination and distraction would tend to equalize themselves.

The tests were scored by counting the number of sections correctly marked on each form. None of the cases included in the results of the investigation had incorrectly marked sections. Several cases were discarded from the total because of obvious misunderstanding of instructions or failure of pens or pencils to function.

The subjects were students enrolled in psychology at the Ohio State University, Ohio Wesleyan University, and Denison University. The testing was done during regular class hours.

RESULTS

Table I gives the results of the investigation for the six groups tested. Column 3 shows the paper stock used for the two test forms in the six groups. The average number of sections scored correctly for each group and the differences between the means of Form A and Form B are given in Columns 5 and 6. The differences in Column 6 have been corrected by the amount of the difference between the mean scores of Test Group 1 on Forms A and B. Test Group 1 (results in row 1) served as the Control Group. In making this correction we have followed the example of Tinker and Paterson.[9] Our control group's average score on Form B was .85 larger than on Form A,—representing presumably the net result of practice and the comparative difficulty of the forms. Consequently, to establish the equivalence of forms for the experimental groups, we subtract .85 from the difference between means.

In an earlier study[10] Tinker and Paterson concluded that the two Chapman-Cook reading forms were equivalent when administered to subjects without previous experience on the tests in the order A–B. We are unable to offer a completely satisfactory explanation for the discrepancy in our control group, where both paper stocks were identical. The difference was consistent in the three university groups which were pooled to constitute the final control. A further attempt was made to check the equivalence of Forms A and B on glossy coated white by using these two test forms on 149 additional students unfamiliar with the material. The mean score for Form A was 15.54, for Form B, 16.19. While this difference of .65 is not as large as the .85 in the control group proper, the discrepancy is in the same direction.

Hence there is some question as to the magnitude of correction to apply. In the study proper the difference of .85

[9] Tinker, M. A., and Paterson, D. G., "Studies of Typographical Factors Influencing Speed of Reading: X, Style of Type Face." *Journal of Applied Psychology*, 1932, 16, 605–613.

[10] *Op. cit.*, p. 4.

TABLE I

TEST GROUP	TEST FORM	PAPER STOCK	NO. OF CASES	MEAN NO. OF SECTIONS SCORED	DIFFERENCE BETWEEN MEANS*	S.D. OF DIS.	S.D. OF MEANS	r	S.D. OF r	S.D. OF DIFF.	DIFF./S.D. DIFF.	PERCENTAGE DIFF.	SUPERIOR SCORE
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	A	Lustro, White	113	15.80	0.85	4.08	.38	.83	.029	.21	.00	0.0	O
	B	Lustro, White		15.65	0.00	3.72	.35						
2	A	Lustro, White	119	15.34	.83	4.11	.37	.75	.040	.25	.08	0.1	A
	B	Lustro, Ivory		16.17	-.02	3.40	.31						
3	A	Lustro, White	119	16.42	.43	4.24	.39	.83	.028	.22	1.90	2.6	A
	B	Lustro, Brilliant-Dull, White		16.85	-.42	3.96	.36						
4	A	Lustro, White	119	16.03	.58	4.45	.41	.80	.033	.25	1.08	1.7	A
	B	Cameo, Ivory		16.61	-.27	4.28	.38						
5	A	Lustro, White	116	15.32	.82	4.19	.39	.73	.043	.29	.10	0.2	A
	B	Olde Style Wove, White		16.14	-.03	4.19	.39						
6	A	Lustro, White	110	16.02	.32	4.01	.37	.75	.042	.23	1.28	3.3	A
	B	Olde Style Wove, India		16.34	-.53	3.11	.29						

* Bold face figures indicate "corrected" differences.

section in the control group may be too large. The scores listed above for the special group of 149 tested with Forms A and B on glossy white stock only were derived by pooling results of 3 classroom groups of students. The averages for each of the 3 groups were: Group 1, Form A, 15.61, Form B, 16.39, (N 73) difference .78; group 2, Form A, 15.61, Form B, 15.77, (N 57) difference .16; group 3, Form A, 15.05, Form B, 16.12 (N 19) difference 1.07. The lack of uniformity in these special test groups is noticeable. The cause of such divergence is difficult to isolate and it seems more than a mere sampling error.

The standard errors of the differences as listed in Column 11 were computed on the basis of the formula for correlated measures.[11] The critical ratios, using the corrected differences, range from 00 to 1.90 and are shown in Column 12. None of the differences noted are significant. The conclusion from these data is that the papers used had no effect on speed of reading.

In 1932 the writers conducted a similar study utilizing college students and the Chapman-Cook Speed of Reading Tests. At that time, however, no control group was employed, but Tinker and Paterson's original statement as to equivalence of forms A and B was accepted without hesitation.[12] The material and method differed slightly from the present experiment. The 30 sections on each form were treated typographically as separate paragraphs. Also, there was no direction sheet on Form A. The experimenter at that time used oral instructions along with an example on the blackboard to demonstrate what was expected in the test performance.

The three forms shown in Figure 1 represent the 1932 test format (left), the 1934 test format (center), and the arrangement of the practice page of the 1934 Form A (right). In the earlier form each item of 30 words was one paragraph while in the present experiment five such items made up one paragraph.

[11] For discussion of this technique see Garret, H. E., "Statistics in Psychology and Education," Longmans, Green and Co., New York, 1926, pp. 128–134, 286–288.

[12] *Op. cit.*, p. 4.

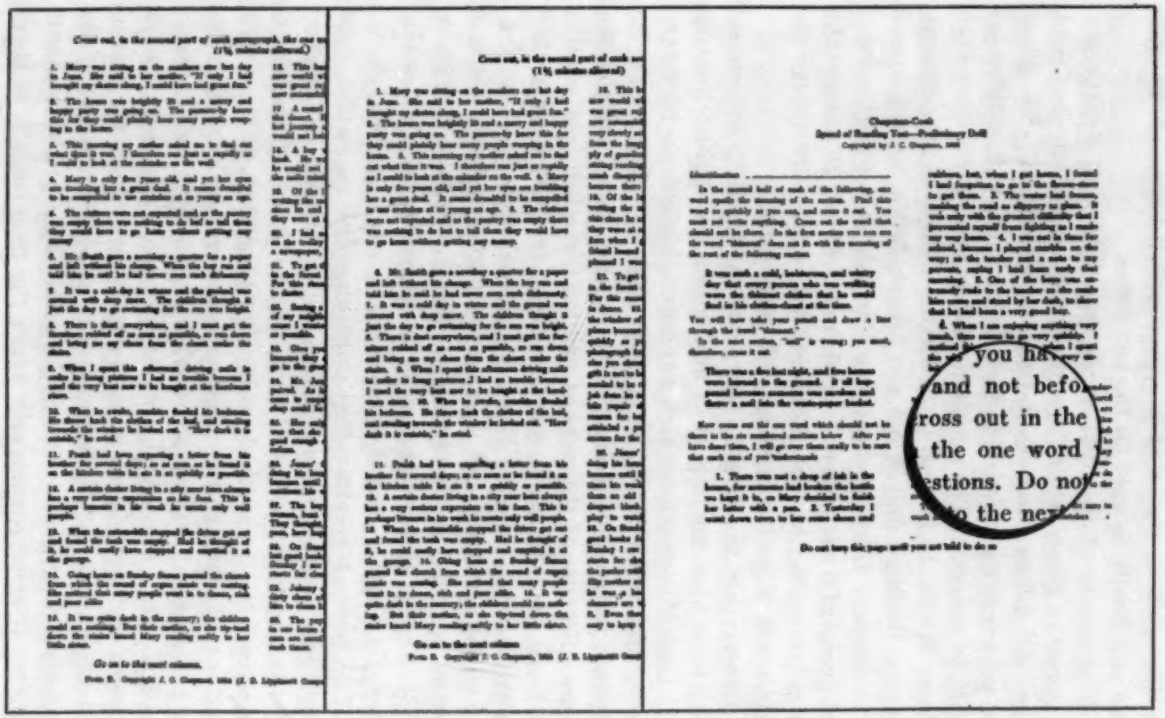

FIGURE 1: 1932 Test Format, 1934 Test Format, 1934 Practice Page

In the circle to the right is reproduced the type of the same size and family as used on the test forms.

The results of the 1932 study established all 5 papers as superior to glossy white from the standpoint of speed of reading. All differences were statistically significant. The greatest superiority was for Olde Style Wove India with a difference of 15.84 per cent. The remaining differences were: Olde Style Wove White, 14.20 per cent; Cameo, Ivory, 11.26 per cent; Lustro, Brilliant-dull White and Lustro, India, 10.28 per cent. The absolute differences between Form A on white glossy and the group of 5 test papers ranged from 1.49 to 2.26 paragraphs. It is interesting to note the magnitude of the differences and attempt to align the findings of 2 years later.

Conceivably the larger differences in the 1932 experiment may have been due in part or totally to some of the following: (1) Lack of correction which was impossible because no control group was employed, (2) Different page layout (supra), (3) Printed instructions accompanied by a series of practice sections. Because of the page of printed directions and practice material the later group may have been further along in their proficiency when taking Form A. If such were the case, then we might venture to say that in the 1932 experiment Form A served partially as a warming up period for Form B while in 1934 the trial sections prepared the subjects in such a way that they did Form A and B at more nearly equal speeds.

The present results after employing the correction show that there is no significant difference statistically in the effect of the paper surfaces and tints on the speed of reading as measured by the method outlined. According to these data dull-coated white and antique india papers are least desirable from a speed of reading standpoint, although in both cases the critical ratios are not significant. If some apparently small factors, such as those mentioned, upset the results to the present extent the writers are inclined to be slightly skeptical of the technique in general. It may be rather susceptible to chance sources of error particularly where the time limit is so short.

It might be advisable to lengthen the test considerably in further work.

With the foregoing qualifications the findings of the experiment do not confirm the opinion and suggestions previously quoted from various authors in the graphic arts field. The results indicate that speed of reading would not be hampered materially if the printer should choose any of the six papers used in the experiment to carry the type impression. He is free to choose a tinted or antique finish for aesthetic values without slowing down the speed of reading.

SUMMARY

A speed of reading test, used extensively by Tinker and Paterson, was employed in the present experiment. It consists of short sections of simple text in which the subject must locate the one wrong word. Two forms A and B were used and always presented in the same order. Form A was on a white glossy coated paper and Form B used six papers—glossy, dull-coated and antique in both white and ivory (or india). The subjects who took A and B on the white glossy constituted a control group and yielded a correction which was applied to the other differences between means of Form A and Form B. The results are negative, *i.e.*, no differences between mean scores on two papers are statistically significant. Tinker and Paterson originally found that the difficulty of Form B just nullified the effect of practice so that no correction was necessary. An earlier experiment by the present writers used the foregoing assumption and found all five surfaces significantly superior to the glossy white. The magnitude of the correction in the present experiment is rather disquieting. The discrepancy may be explained partially by slight differences in format and procedure but it seems that chance errors may play a serious role in a test as short as 1¾ min. The only conclusion warranted with the present technique are that surface and yellowish tint of paper do not influence speed of reading to a significant degree.

THEORIES OF HANDEDNESS

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INTRODUCTORY

MUCH has been published concerning various aspects of right and lefthandedness, particularly with the recent emphasis on handedness in the study of the mental hygiene of the individual. Studies and experiments in the field have multiplied prodigiously. The majority of the material available, however, is highly specific and usually in line with the author's pet thesis. This review is an attempt to present, integrate, and criticize the major theories of Handedness and point out the objectives toward which studies and experiments are leading.

Maladjustment of the Lefthanded. A moment's reflection will reveal the fact that most of the apparatus of our civilization is adapted to the convenience of the righthanded person. Consider the social usages of dextrad writing, shaking hands with the right, table settings arranged for the convenience of the righthanded. Tools and machines are made for the righthanded, from the simple scissors and scythes to levers and switches of modern industrial production. The lefthanded individual in the classroom is handicapped to a very marked degree, since the desks and lighting arrangements are suited to the needs of the righthanded child. Moreover, he receives less help from the teacher in learning to write, and must stand the mockery and ridicule of classmates. It is conceivable that lefthandedness may result in a lifelong inferiority complex or other maladjustment.

Early predominance of Righthandedness. Righthandedness seems to have been a characteristic of the human race for countless ages. Experts have affirmed the cave drawings and

flint instruments to be the work of righthanded men. We have the mute evidence of the ancient Egyptian, Babylonian and Greek sculpture; and the Bible refers to the "seven hundred lefthanded Benjamite slingers"[1] as an oddity.

Prevalence of Handedness. There is a wide range of opinion as to the prevalence of lefthandedness among the normal population. Estimates have been placed as low as 2 per cent and as high as 30 per cent.[2] If brainedness is taken as the measure of natural handedness, the high estimate is more correct. Most authorities, however, place the estimate from 4 to 8 per cent, with the consensus of opinion centering around 5 per cent. Lefthandedness seems to be more prevalent in institutions for the mentally defective and the criminal; reports are conflicting as to relationship with sex.

Tests for Handedness. As yet no single test has been discovered whereby an individual's native handedness can be determined. Many tests have been suggested for this purpose, among them tests for strength of hand grip, rate of tapping, accuracy of training, measurement of arm and hand bones, hand used in writing, eating, cutting, sweeping, batting, winding, etc. Writing is the popular criterion, but it is by no means accurate as we shall see. Tapping is the test most widely favored by experimenters; Goodenough (19, p. 131) gives complete directions for use and computes the score by subtracting the left hand score from the right hand score. Thus, a positive score would indicate righthandedness and *vice versa.*

Handedness in relation to intelligence. A popular belief is that Lh.[3] persons are of inferior mentality and morals, and

[1] Judges. Ch. 20, 16.

[2] Baldwin (1)—2 per cent; Lombroso (38)—4 per cent; Gould (21)—6 per cent; Mills (40)—11 per cent; Ramaley (46)—16.6 per cent; Parson (42)—29.3 per cent; Bardleben (3)—32.8 per cent.

[3] Abbreviations: R.—right; L.—left; H.—handedness; Rh.—righthandedness; Lh.—lefthandedness.

many ignorant parents take great pains to conceal their children's Lh. Haefner (22) has made a very reliable study as to the comparative intelligence ratings of a group of Lh. and Rh. children when sex, chronological age, and school grade was kept constant. The results showed a difference of about 1.40 IQ in the Mean, and conclusively prove that no real difference in intelligence exists between the two groups. Wilson (62) and Pyle and Drouin (45) claim to have found a slight superiority of the dextrals in intelligence, but the latter attribute the inferiority of the Lh. to the handicap of their social environment. There is an entirely different basis for this popular fallacy; Lh. was found to be present in 18.2 per cent of the inmates in a school for mental defectives (20).

PART I—THEORIES OF ACQUIRED HANDEDNESS

Several theories have been advanced as to the cause of H. They differ in particulars, but all claim that h. is an acquired characteristic due to conscious or unconscious social pressure.

A. *Primitive Warfare Theory*

This theory was early advanced to explain handedness. It claims that since the heart is on the left side of the body, it has to be protected by a shield held in the left hand. This leaves the right hand free to fight with club or sword, which is more convenient also, inasmuch as the right hand is more accessible to the left side of the enemy's body and the vicinity of the heart. Thus the constant use of the right hand caused it to develop to a much greater degree than the left. The use of the right hand was then transmitted by custom or heredity. This theory arose in the latter part of the 18th century and was advanced by Carlyle (9) in his diary. Since then it has been restated time and again (21).

We cannot accept the idea that this acquired Rh. was hereditarily transmitted, since it conflicts with the Mendelian Law of acquired characteristics. Besides, heredity involves the woman who did not bear arms; in that case the offspring

would have just as much chance of being ambidextrous as R. handed. Watson modifies the idea to support his theory.

> "It was easy for our most primitive ancestors to learn that men who carried their shields with the left and hurled their spears with the right, were the ones who most often came back bearing their shields rather than being borne on them. . . . they began to teach their young to be Righthanded." (57, p. 321)

The day of writing and manuscripts appeared, and the "strong right arm" became embedded in our tradition and folklore.

B. *Position of Infant in Arms*

Plato first suggested that H. might unconsciously be developed in the child by the manner in which the mother held it in her arms (44). A Rh. mother would hold her child in her right arm, the stronger arm, and the child's right arm would be free to exercise, the left arm being pressed close to the mother's body. However, more reasonable and more highly confirmed by experience, is the fact that the mother would hold her child in her left arm so that the right arm would be free to tend it. Thus the left arm would be free to develop and all children should consequently be of opposite H. to their parents, which is by no means the case.

C. *Habit and Training*

This is the modern and most logical theory in this group. As the name implies, it denies that H. has any innate basis whatsoever—it being brought on by training, witting and unwitting. The theory can be traced back to Sir Thomas Browne (7) in his *Vulgar Errors* written in the 17th century. The greatest modern exponent of the theory is John B. Watson, the Behaviorist. "Most individuals are Righthanded and it is natural to suppose that we would try to instill in youngsters, almost from the very beginning, the dominance of the right hand. We bring this about possibly even without

trying to by handing objects towards the child's right, by shaking its right, and leaving the right hand free when carrying it in our arms" (56, p. 500). As the child grows older, the pressure becomes more conscious and strict.

> "Our whole group of results in handedness leads us to believe that there is no fixed differentiation of response in either hand until social usage begins to establish handedness. Society soon thereafter steps in and says, 'Thou shalt use thy right hand.' Pressure promptly begins. 'Shake hands with your right hand, Willy.' We hold the infant so that it will wave Bye Bye with its right; we force it to eat with the right. This in itself is a potent enough conditioning factor to account for handedness" (57, p. 321).

Baldwin and Wooley's experiments. Professor Baldwin (1) in 1894 carried out tests with his own child extending from the fifth to the ninth month. He eliminated as far as possible the element of suggestion in order to determine whether or not H. would develop spontaneously. He reported signs of Rh. in the sixth and seventh month after birth, and a "distinct preference" shown in the seventh and eighth months. Mrs. Wooley (63) in 1910 conducted a similar test and obtained practically the same results. These tests may be criticized as being unrepresentative, but more important than this is the possible explanation that the tendency of the child to develop Rh. was occasioned by the convenience gradually discovered in using his R. hand, since all the simple objects and even his toys, were especially adapted for the use of the R. handed.

Watson's experiments. Watson tested newborn children for H. by their ability to remain suspended. Each of the 20 children was tested at birth and each day thereafter, for a period of ten days. "Our results show conclusively that the infant does not suspend itself on the average with the right hand for a longer time than with the left." (56, p. 500). The results of the tests in suspension showed superiority of

the R. 3 times; of the L. 6 times; and equal once. In measurement by the "work adder," a device which consists of a weight which is raised a little every time the infant moves his arms, Watson found almost identical results for both hands for the entire ten day period. On particular days there might be a disparity between hands, but the average was the same over the long period of time. The results of all of his other experiments on the same subject serve to verify his previous conclusions. In testing infants as to hand preference in reaching for striped peppermint candy he found that no important difference can be detected between hands; the child stretched out one, the other, or both hands indiscriminately (57, p. 319–321).

Later appearance of Handedness. Watson's experiments prove that H. does not exist at birth, or if it does exist it does not manifest itself. "Handedness, like beards and wisdom teeth, appears after birth" (26, p. 132). It develops very gradually and improves in skill or dexterity (note the derivation of the word) as time goes on. Baldwin (1) records that his nine months' baby used the R. hand generally, but for difficult action, such as catching a swinging object, etc., it used both hands. At what rate, then, does hand preference develop? It was reported present by Lippman (37) in 70 per cent of infants one year of age; by Hicks (25) in 90 per cent 2–6 years of age; by Jenkins (30) in 85–90 per cent between 5 and 6 years. Jones (32) in a carefully worked out paper on the subject, computed a dextrality ratio representing the fraction of the total time the R. hand was used in his tests. The tests consisted of form-boards, building blocks, etc., and were carried out on children from $1\frac{1}{2}$ to $5\frac{1}{2}$ years of age. The values he found for the four groups, ages $1\frac{1}{2}$–$2\frac{1}{2}$, $2\frac{1}{2}$–$3\frac{1}{2}$, $3\frac{1}{2}$–$4\frac{1}{2}$, $4\frac{1}{2}$–$5\frac{1}{2}$, were respectively: .67, .69, .78, .81.

Ambidexterity. It would perhaps be well at this point to delve into the problem of ambidexterity. Is there a possibility, if the child were totally unrestrained, that it would be

able to use both hands with equal dexterity? Scheidemann says;

> "In ambidexterity, both hands are equally efficient or, as is more often the case, inefficient. It is possessed by anthropoid apes, . . . and is more common among delinquents and idiots than among normal persons. Some investigators found ambidexterity more prevalent among the dull and backward whites, still others found that it is more common among the lower human races, notably Hottentots and Bushmen" (50, p. 141–142).

This would seem to show that there is something beyond social usage in the explanation of H. than Watson claims there to be.

"Handedness" in animals. Furthermore, in the lower animals, among whom we can reasonably believe no special training takes place, there is some evidence of H. Peterson (43) in testing seven white rats, discovered four to be "right-handed," two "lefthanded" and one "ambidextrous." Tsai and Maurer (55) in a much more thorough study, using a larger number of rats, tested for H. by requiring them to reach through an opening with one paw, to obtain food. The rats had been divided into two groups, the normal and those who had been fed a Vitamin B-deficient diet. The normal rats were found to be predominantly R. handed and the deficient rats were about evenly divided. We cannot as yet draw any conclusions from these results, nor can we draw any comparisons with the human race until more extensive and repeated experiments confirm their findings. They are, however, highly suggestive in many details.

Watson's theory and the lefthanded child. The data gathered on growth of H., and H. in animals, would lead us to believe that there is a deeper element in H. than the mere "social pressure" idea. One problem which Watson does not attempt to solve, and which shatters his theory, is the fact that, regardless of all the training given them, lefthanded children *do* appear, and despite all the pressure brought to bear they continue to be Lefthanded.

This fact forces us to look elsewhere for an explanation.

PART II—STRUCTURAL THEORIES

A. *Visceral Distribution and Displacement of Center of Gravity*

This theory rests upon the fact that the viscera are unequally distributed throughout the thorax. The heart and the larger part of the intestines are on the left side of the body. This would tend to cause the center of gravity of the body to shift a few degrees toward the left, giving the limbs on the right side the mechanical advantage over those on the left side. Furthermore, it has been found that exercise of the left side of the body has greater effect on heart action; the greater weight of lungs and liver, the organs that cause the inspiration that precedes muscular efforts, are on the right. These factors favor greater use of the right side of the body; consequently, the right hand ought to be superior in strength and activity to the left. This theory was first proposed by Buchanan (8) in 1862. It has not had a great deal of popularity for obvious reasons. It would presuppose that L. handed persons had a transposed visceral arrangement. L. handed persons are of identical internal arrangement as the R. handed; and while there are a few people with transposed viscera, they are so rare as to be considered freaks and the percentage of Lh. even among these is low. Finally, as has been already stated, the visceral arrangement of anthropoid apes is identical to that of humans and yet we find not the lightest trace of hand preference among them.

B. *Origin of Subclavian Arteries*

This theory may be considered an addition to the previous one. It was advanced in the 1860's by the Viennese anatomist, Hyrtl (29). Briefly, it depends on the origin of the subclavian arteries, those arteries which carry blood from the trunk to the arms.

> "It happens in the proportions of about 2 in 100 cases that the left subclavian artery has its origin before the

> right, and in these cases lefthandedness exists, . . . and it is found that the proportion of lefthanded to right-handed persons is also about 2 to 100" (29, p. 305).

It is a theory of the "armchair" variety and not borne out by observation or ascertained fact as a number of subsequent investigations have shown.

C. *Size of Bones in Arm*

This idea was first conceived by W. Jones (33) in 1917. In deriving his test he assumed that if the individual is either born with, or has developed a superior hand, such facts will be revealed by the tape line. After measuring 20,000 pairs of arms he concludes that the R. hander is born with larger bones in the R. side of the body, and the L. hander is born with a similar development in favor of the L. side.

Jones' tests. In order to detect inborn H. and the adopted H. of human beings, Jones constructed an instrument, the Brachiometer, and devised the following system of measurements: 1. Length of Ulna Plus. 2. Circumference of the palm. 3. Circumference of the wrist. 4. Length of the Humerus. In adopted H., the adopted arm excels in the muscle swells in these: 1. Relaxed forearm. 2. Contracted forearm circumference. 3. Circumference of the relaxed biceps. 4. Circumference of contracted biceps. The preferred hand has the greater muscular development due to constant use.

Beeley's experiments. Beeley (4), using Jones' test, measured the bones of 100 first grade children. "These tests show, according to the measurements of both ulna and humerus; 46 per cent of the children were R. handed, 40 per cent were L. handed, and 14 per cent were doubtful or ambidextrous." (p. 10). The actual H. of the children was 94 per cent R., 3 per cent L., and 3 per cent doubtful or ambidextrous. Beeley experimented again with kindergarten children. "The experimental applications of the Jones Brachiometer tests prove its unreliability for extensive use, and also

the invalidity of the theory on which it is based, viz., that native Handedness can be determined at any age by bone measurements'' (p. 12).

D. *Position of Child in Uterus*

This idea can scarcely be called a theory. It was suggested by Watson in his now classical article, ''What the Nursery Has to Say About Instincts'' (57, p. 308).

> ''While in the uterus the infant's attitude or position conforms to the general outline of the uterus. The extent to which slight differences in the intra-uterine position of the foetus may possibly later influence or even determine Right- and Lefthandedness of the individual, is unknown. Attention is called to the fact that the liver is on the right side in 80 per cent of the cases observed. Whether this large organ may swing the foetus slightly so that the right side is constantly under less restraint than the left, is not known. If this is true the infants with the liver on the right side should be Righthanded from birth. My records on 100 children prove that this is not so.''

A USEFUL METHOD FOR STUDYING TRAFFIC SAFETY PROBLEMS AT STREET INTERSECTIONS. A PRACTICAL APPLICATION IS REPORTED

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Introductory

THE increasing toll in form of personal injury and property damage resulting from street and highway traffic accidents must eventually lead to thorough scientific studies of the accidents and their causes. The Safety Departments of many municipalities and the Highway Departments of several states have already accumulated valuable data concerning traffic accidents. One insurance company has undertaken to summarize these data in their annual publications.[1] These statistical summaries indicate that although the factors extraneous to the driver and pedestrian—inclement weather, poor street conditions, inadequate street lighting, and unfavorable conditions of the vehicle—each are somewhat related to the occurrence of small proportions of the accidents, the preponderant causes lie essentially in the actions of the drivers and the pedestrians.

The psychological nature of the problems of street and highway safety was recognized as early as 1919 by a group of research workers who made a few preliminary investigations of certain psycho-motor reactions of automobile drivers.[2] In addition, considerable experimental work has been done concerning the use of color, lettering and shape in highway warning signs and markers. However, objective studies of the drivers' actions at the time of accident have not been prevalent.

[1] The Travelers Insurance Company. "The Great American Gamble." 1934, Hartford, Connecticut, pp. 1–55.

[2] Monograph. "Psychological Principles in Automotive Driving." Columbus, Ohio State University Press, 1931, pp. 1–160.

The records of the accidents used in this research did not include extensive or valid accounts of the actions of the drivers and pedestrians at the time of the accident, but accurate descriptions were given of the accident situation. Hence, it was possible to classify the accidents into types according to the direction of movement and the angle of collision. This served as an objective approach to the actions of the drivers and pedestrians, and not only enabled the comparison of different types of accidents according to severity, but once the prevalent types of accidents were known, it was possible to suggest promising means of traffic control with a view to diminishing the occurrence of the most frequent and most severe types of accidents.

The Classification of the Accidents According to Types

The analysis of 2,173 records of traffic accidents occurring between June 1, 1931, and December 31, 1933, at 191 congested street intersections where traffic is presumably controlled by traffic signal lights, was the basis of the following classification of accidents into types according to the direction of movement and the angle of collision. Each symbol is described by means of a phrase appearing to the right of the symbol.

A Graphic Classification of the Common Types of Accidents

● signifies pedestrian.
→ " path of vehicle.

(1) *Vehicular Collisions with Pedestrians*

1. →● Straight into pedestrian.
2. Right turn into pedestrian.
3. Left turn into pedestrian.
4. Pedestrian walks into the side of a vehicle straight through.
5. Pedestrian walks into the side of a vehicle turning right.

6. Pedestrian walks into the side of a vehicle turning left.
7. Straight into two pedestrians.
8. Right turn into two pedestrians.
9. Left turn into two pedestrians.

(2) *Vehicular Collisions with Other Vehicles*

(a) When the vehicles have been proceeding in the same directions:

A. Rear-end collision, both vehicles straight through.
B. " " first vehicle turning right.
C. " " " " " left.
D. Angle collision, right turn into the path of following vehicle.
E. Angle collision, left turn into the path of following vehicle.
F. Side-swipe, one vehicle "cutting in" toward curb.
G. " " " "cutting out" from curb.
H. " both vehicles turning right.
J. " " " " left.
K. Rear-end collision, the leading vehicle backing.

(b) When the vehicles have been proceeding in opposite directions:

L. Head-on collision of vehicles proceeding straight through.
M. Head-on collision, one vehicle turning right.
N. " " " " " left.
P. Side-swipe collision, one vehicle turning left, the other right, to proceed in the other direction.
R. Side-swipe collision, to proceed in opposite directions.

(c) When the vehicles have been proceeding at right angles:

S. → ↑ Right-angle collision, both vehicles straight through.

T. → ↱ Angle collision, one vehicle turning right to proceed in same direction.

U. ↰ ← Angle collision, one vehicle turning left to proceed in same direction.

V. ↱ ← Angle collision, one vehicle turning right to proceed in opposite direction.

W. → ↰ Angle collision, one vehicle turning left to proceed in opposite direction.

X. ↳ ↰ Side-swipe, one vehicle turning left, the other right.

Y. ↔ ↑ Right-angle collision, one vehicle backing.

(3) *Vehicular Collisions with Fixed Objects*

a. → ■ Straight into side pole.

b. ↱ Right turn into side pole.

c. ■ ↰ Left turn into side pole.

d. →— Straight into loading platform.

e. →⊙ " " fire hydrant.

f. →○ " " traffic signal.

g. →⊗ " " other fixed objects.

h. ▲ Non-collision.

z. Z All other types of accidents.

The Frequency-Injury Ratio

From this standpoint of public safety and the consideration of means of traffic control, it is desirable to know not only how many accidents of a given type occur, but also how severe a given type of accident is in the way of personal injury as defined in terms of removal or non-removal to a hospital or physician's office for medical attention. It is possible to combine both the measures of frequency and of injury into a composite score, the frequency-injury ratio, which is a product of two other ratios, *i.e.*, the percentage of injury occurring per type of accident times the percentage of total frequency of occurrence of the same type of accident.

Table 1

The Distribution of the Various Types of Accidents According to Non-injury, Injury, Total Frequency, Percentage of Injury, Percentage of Total Frequency, and Frequency-injury Ratios for Both the Control and the No-control Periods

Type of Accident	*Control Period*						*No-control Period*					
	Frequencies			Percentages		Frequency-injury Ratio	Frequencies			Percentages		Frequency-injury Ratio
	Injury	Non-injury	Total	of injury	of total		Injury	Non-injury	Total	of injury	of total	
1	235	176	411	57.1	21.3	1,216	3	2	5	60.0	2.1	126
2	26	17	43	60.5	2.2	133	1	1	2	50.0	0.8	40
3	31	27	58	53.4	3.0	160	.....	.....	.....	.....	.....	.....
4	20	21	41	48.8	2.1	102	1	.....	1	100.0	0.4	40
5	3	2	5	60.0	0.3	18	.....	.....	.....	.....	.....	.....
6	5	5	10	50.0	0.5	25	.....	.....	.....	.....	.....	.....
7	4	6	10	40.0	0.5	20	1	.....	1	100.0	0.4	40
8	1	3	4	25.0	0.2	5	.....	.....	.....	.....	.....	.....
9	2	2	4	50.0	0.2	10	.....	.....	.....	.....	.....	.....
A	45	208	253	17.8	13.1	233	5	8	13	38.5	5.4	208
B	1	11	12	8.3	0.6	5	.....	3	3	.....	1.2	.....
C	4	21	25	16.0	1.3	21	1	1	2	50.0	0.8	40
D	1	14	15	6.6	0.8	5	.....	.....	.....	.....	.....	.....
E	3	17	20	15.0	1.0	15	.....	.....	.....	.....	.....	.....
F	2	22	24	8.4	1.2	10	.....	1	1	.....	0.4	.....
G	5	16	21	24.0	1.1	26	.....	1	1	.....	0.4	.....
H	.....	6	6	.....	0.3	.....	.....	.....	.....	.....	.....	.....
J	.....	2	2	.....	0.1	.....	.....	.....	.....	.....	.....	.....
K	1	13	14	7.1	0.7	5	.....	.....	.....	.....	.....	.....
L	27	63	90	30.0	4.7	141	4	7	11	36.3	4.6	167

Table 1.—Continued

Type of Accident	*Control Period*						*No-control Period*					
	Frequencies			Percentages		Frequency-injury Ratio	Frequencies			Percentages		Frequency-injury Ratio
	Injury	Non-injury	Total	of injury	of total		Injury	Non-injury	Total	of injury	of total	
M	1	5	6	16.6	0.3	5	.....	.....	.....	.....	.....	.....
N	57	212	269	21.2	13.9	295	4	9	13	30.8	5.4	166
P	1	3	4	25.0	0.2	5	.....	1	1	.....	0.4	.....
R	2	1	3	66.6	0.2	13	.....	.....	.....	.....	.....	.....
S	92	230	322	28.5	16.7	476	28	83	111	25.2	46.3	1,167
T	3	10	13	23.1	0.7	16	1	2	3	33.3	1.2	40
U	13	24	37	35.1	1.9	67	.....	5	5	.....	2.1	.....
V	4	30	34	11.8	1.7	20	2	3	5	40.0	2.1	84
W	6	40	46	13.0	2.4	31	2	5	7	28.5	2.9	83
X	1	1	2	50.0	0.1	5	.....	.....	.....	.....	.....	.....
Y	1	2	3	33.3	0.2	7	.....	.....	.....	.....	.....	.....
a	10	16	26	38.5	1.3	50	4	8	12	33.3	5.0	167
b	2	9	11	18.2	0.6	11	1	.....	1	100.0	0.4	40
c	.....	3	3	.....	0.2	.....	1	3	4	25.0	1.7	43
d	15	23	38	39.5	1.9	75	10	14	24	41.7	10.0	417
e	.....	2	2	.....	0.1	.....	.....	1	1	.....	0.4	.....
f	.....	11	11	.....	0.6	.....	1	4	5	20.0	2.1	42
g	1	11	12	8.3	0.6	5	1	5	6	16.6	2.5	42
h	11	2	13	84.6	0.7	59	2	.....	2	100.0	0.8	80
Z	1	9	10	10.0	0.5	5	.....	.....	.....	.....	.....	.....
Total	310	1,037	1,347		100.0		76	164	240	.....	100.0	.....

The method of computing the frequency-injury ratio is illustrated below in table 1 which lists the injury and non-injury frequencies, percentages, and frequency-injury ratios for both the control period and the no-control periods. The stubs in the first column list the types of accidents as outlined in the classification. Columns 2 to 7 summarize the data for the control period, while columns 8 to 13 summarize the data for the no-control period. Column 2 lists for each type of accident the number of accidents involving personal injury. Column 3 lists the number of accidents per type, not involving personal injury. Column 4 gives the total frequencies per type of accident (sums of adjacent entries in columns 2 and 3). Column 5 lists the percentages of injury per type of accident (entry in column 2 divided by the corresponding entry in column 4). Column 6 gives the percentages of total frequency per type of accident (each entry in column 4 divided by the sum of the entries in column 4. Finally, column 7 lists the frequency-injury ratios per type of accident (the product of the adjacent entries in column 5 and 6). The remainder of the table gives similar data for the no-control period.

The Method Applied to a Practical Traffic Problem

The study was confined to the consideration of the traffic accidents occurring at 191 street intersections in Cincinnati where traffic signal lights were located. The problem comprised the comparison of the accidents occurring while the signal lights presumably controlled traffic flow (6 A. M. to 2 A. M.) with the accidents occurring after the signal lights had been switched off (2 A. M. to 6 A. M.) when there was a four hour period of no-control.

The object of the study was to determine what means of control might be suggested for use during the no-control period. The method used was that described above, the data being tabulated for both the control and the no-control periods according to the frequency and severity per type of accident, and frequency-injury ratios being calculated as shown in Table 1.

The resulting frequency-injury ratios per type of accident are shown as points in the lines in Figure 1 where the solid line represents the control period and the broken line the no-control period.

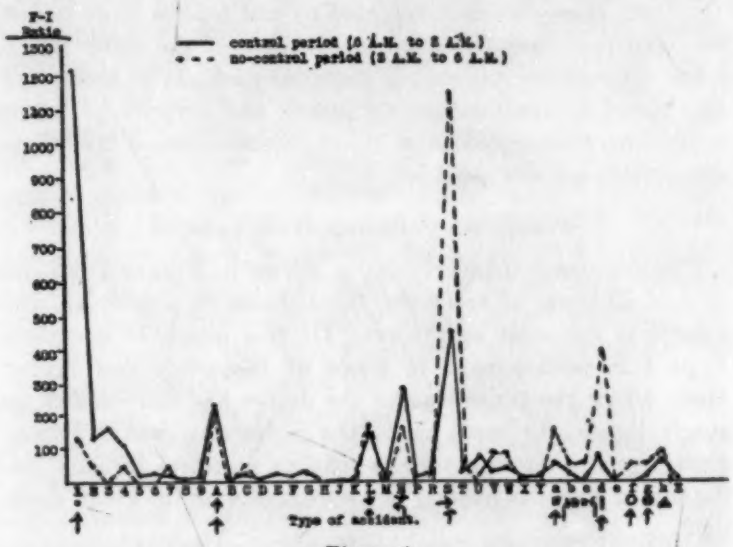

Figure 1

A Comparison of the Frequency-injury Ratios for Each Type of Accident Occurring During the No-control Period *Verus* Those Occurring During the Control Period

A comparison of the lines in Figure 1 shows that from the standpoint of both frequency and injury, the pedestrian collisions with vehicles (Type 1) predominate during the control period, while the right angle collisions of vehicles with other vehicles (Type 5) and the collisions of vehicles with fixed objects (Types a to h) predominate during the no-control period. These relationships might be expected inasmuch as more pedestrians use the cross walks during the daytime and early part of the night; and since there are no control lights during the early morning hours, relatively more motorists cross the intersections without slowing down sufficiently to prevent

a right angle collision with other vehicles. The increased drowsiness of the drivers during the early morning hours accounts for the increased incidence of the collisions of vehicles with fixed objects such as side poles and loading platforms (elevated safety zones barricaded by red beacon light stanchions and iron work). Since the purpose of the study was to make suggestions concerning plausible methods of traffic control aimed to diminish the frequency and severity of injury coincident with collisions at street intersections, a few of the suggestions are discussed below.

Pedestrian Collisions With Vehicles

The frequency-injury ratios as shown in Figure 1 indicate that of all types of accidents, the collision of pedestrian with vehicle is the most significant. Of this group of accidents, Type 1 is predominant in terms of frequency and injury. Here, either the pedestrian or the driver has disregarded the single light. In some cases, the pedestrian was indiscreet enough to step from a curb or loading platform directly into the side of a vehicle passing in accordance with the green signal light.

With a view to diminishing both the frequency and the severity of pedestrian collisions with passing vehicles, it is suggested that in addition to ascertaining that he has the green signal light in his favor, the pedestrian should be induced to glance to the side from which traffic is approaching before he steps into the crosswalk. Such a habit on the part of the pedestrian would be for his own protection and might be thoroughly established in school children as part of their safety education. The education of adults would necessarily be less direct, but might be accomplished through newspaper and placard propaganda, and perhaps most effectively by traffic policemen specifically directed to instruct negligent pedestrians as well as drivers of vehicles. This might be effectively accomplished by equipping police cruisers with loud speakers, so that the officers might direct motorists as well as pedestrians.

The Right Angle Collision of Vehicles with Other Vehicles

The reduction of the accident rate coincident with pedestrian collisions with vehicles is largely a problem of the daytime and early evening when the traffic flow is presumably controlled by the operation of traffic signal lights. The remainder of the problems touched upon in this research are associated with the early morning hours when the traffic flow is not controlled by the operation of traffic signal lights.

A glance at Figure 1 will indicate that there is a marked increase in the frequency and severity of the right angle type of collision (Type S) during the no-control period. In this type of accident, two or more vehicles collide after having approached an intersection at right angles to one another, and without slowing down sufficiently to enable one driver to stop in accordance with the right-of-way regulation permitting the vehicle approaching from the right to proceed.

Since there is such a discrepancy between the frequency-injury ratios for the control *versus* the no-control period, it is suggested that the incidence of right angle collisions occurring at intersections where traffic lights are located would be appreciably diminished were the signal lights operated throughout the night. Another, but possibly less desirable method of control, would be to place stop signs facing the intersecting street having the least traffic flow, the stop signs to be effective when the traffic lights are not operated. From a psychological standpoint, the desirability of the latter method is questionable since it might lead to a conflict in driving habits and consequently tend to diminish the effectiveness of stop signs in general.

The Loading Platform

Although the vehicular collisions with side poles, fire hydrants, traffic signals and other fixed objects all show slightly increased frequency-injury ratios for the no-control period, the increase is most marked for the collision of vehicles with loading platforms. It is quite true that the loading platforms were located directly in the paths of fast moving automobile traffic,

but they were clearly visible, being painted white and thoroughly illuminated by two red drop lights and a red beacon light supported by a heavy iron stanchion and located some five feet above the end of the loading platform facing the approaching vehicular traffic. Thus, it is obvious that if the drivers were normally alert from a psycho-motor standpoint, they should in most cases avoid collisions with loading platforms. However, largely due to a relatively higher incidence of drowsiness during the early morning hours, this type of accident sometimes exacts its toil in terms of human lives and demolished automobiles.

Were the loading platforms removed together with their barricades, there would be no accidents attributed to this obstruction, but there would probably be a higher rate of vehicular accidents involving pedestrians while the latter were boarding or leaving street cars. It is the policy of the safety authorities to safeguard the street car passengers which according to one survey made in San Francisco constitute approximately 70 per cent of the passengers entering or leaving the business district of that city.[3]

The safety value of the loading platform might well be thoroughly investigated before recommendations are made concerning its elimination. However, one type of modification seems plausible. Were the platforms to remain elevated about six inches above the pavement and lighted by the two red drop lights, but the barricades removed and replaced by "mushroom" lights at the ends facing the approaching traffic, it is likely that the pedestrians would be reasonably well protected since it would be inconvenient for the driver to strike the elevated platform, but if during the early morning hours he dozed off at the wheel, his automobile would not be demolished, nor is it likely that he would subsequently be removed to the morgue.

The maintenance of the traffic signal lights throughout the night might also tend to diminish the frequency and injury

[3] The Annals of the American Academy of Political and Social Science, Vol. 133, No. 122, Sept., 1927.

of collisions with loading platforms and other fixed objects inasmuch as the driver must necessarily make some motor reactions from time to time as he handles the controls of his automobile in response to traffic light signals. Such occasional occurrences of muscular activity together with the attention directed toward the signal lights might go far toward diminishing the degree of drowsiness. Moreover, the maintenance of the traffic lights throughout the night might enable the policemen in cruisers to prevent certain accidents by observing the actions of the early morning drivers in response to the signal lights. If the driver disregards the signal light altogether, he may be apprehended and questioned to determine whether he has disregarded the light intentionally, or whether his psychomotor reactions are retarded due to illness, fatigue, or alcoholic intoxication. The offending driver may then be disposed of to the advantage of public safety.

Summary

By classifying traffic accidents into types according to the paths taken by pedestrians and vehicles immediately preceding collision, and by combining into a "frequency-injury ratio" the frequency of occurrence of each type of accident together with the severity of the same type of accident, it was possible to study objectively the accidents occurring under different conditions and to suggest plausible means of traffic control.

In one study it was found that one type of vehicular collision with pedestrian far exceeded any other type of accident in both frequency and severity during the daytime and early evening when traffic was presumably controlled by traffic signal lights. To diminish the incidence of this type of collision, it was suggested that for his own protection the pedestrian must be induced to look toward approaching vehicular traffic regardless of traffic light signals.

During the early morning hours when the signal lights were not operated, the right angle type of collision predominated

and there was also an increased incidence of vehicular collisions with fixed objects. To diminish both the frequency and severity of these types of accidents, it was suggested that the signal lights be operated throughout the night. This measure would presumably stop one stream of intersecting traffic thereby reducing to a minimum the frequency of the right angle type of collision. Moreover, the occasional motor reactions of the drivers in response to the changing signal lights might go far toward reducing the effect of drowsiness characteristic of many early morning drivers thereby reducing both the frequency and the severity of vehicular collisions with fixed objects.

AN OBJECTIVE TECHNIQUE FOR BEGINNING THE INTERVIEW WITH CERTAIN TYPES OF ADULTS

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VERY young children often present difficulties for the interviewer and even when responses are given, they may lack the desired frankness and significance. Hence some interviewers have utilized a doll as an intermediary. The questions are related to the doll, and the child describes how the doll would feel or of what it would be thinking in the various situations. Children's responses given in this objective fashion may reflect more adequately the attitudes of the subjects. This interview technique usually establishes *rapport* quickly; and, when skillfully managed, reveals many leads for subsequent interviews.

Schwartz[1] has adapted this interview technique for use with delinquent boys between seven and fifteen years old. A series of eight pictures, nine by twelve inches, is used as the intermediary. These pictures, known as the Schwartz Social Situation Test, are useful in opening the interview. They allow the utmost frankness and objectivity on the part of the subject, and they serve the purpose of establishing *rapport*. Many attitudes which would be concealed from an interviewer are quickly brought to light as the subject discusses the pictures. Schwartz reports that the use of this interview technique has decided advantages in the psychiatric interview.[2]

The purpose of this investigation is to determine the suitability of an intermediary in the initial stages of adult interviewing. An intermediary may be defined as any hypotheti-

[1] Louis A. Schwartz, Social Situation Picture Test. C. H. Stoelting Company, Chicago, 1931.

[2] Louis A. Schwartz, "Social-Situation Pictures in the Psychiatric Interview," *Journal of Orthopsychiatry* (April, 1932), II, pp. 124–133.

cal situation, problem, or test in which the subject reveals his own attitudes indirectly. If, for instance, a social situation could be acted out before the subject and his interpretation of the scene frankly and completely given, his attitudes would be elicited by an intermediary. Owing to practical difficulties in the way of arranging real situations or of obtaining motion pictures of meaningful social situations, the Schwartz pictures were used in this investigation.

The subjects chosen for this report were found in a state home for delinquent women. All subjects were white. The following information was obtained from case records:

Case One: larceny, three years; chronological age 24, mental age 16 – 2; single; no previous arrests.

Case Two: prostitution, three years; chronological age 23, mental age 11 – 2; single; no previous arrests.

Case Three: involuntary manslaughter, one to two years; chronological age 38, mental age 14; divorced, one daughter; no previous arrests.

Case Four: larceny, three years; chronological age 24, mental age 13 – 11; single; five previous arrests.

Case Five: larceny and receiving stolen goods, indeterminate sentence; chronological age 31; mental age 14 – 6; single; one previous arrest, fine.

Case Six: unlawful possession and use of drugs, indeterminate sentence; chronological age 20; mental age 14 – 9; divorced, no children; one previous arrest.

Case Seven: incorrigible, indeterminate sentence; chronological age 19; mental age 10 – 7; single; one previous arrest.

Case Eight: forgery, indeterminate sentence; chronological age 21; mental age 10 – 4; single; no previous arrests.

Case Nine: incorrigible, indeterminate sentence; chronological age 16; mental age 10 – 5; single, one child—colored; no previous arrests.

Case Ten: idle and disorderly person, indeterminate sentence; chronological age 19; mental age 10 – 8; single; six previous arrests.

Although in the whole investigation over forty persons were interviewed with the Schwartz pictures, stenographic reports

of the responses could be obtained only from these ten cases cited above. All these subjects appeared to enjoy the test and to answer with desired frankness.

Picture One in the Schwartz Social Situation Picture Test shows a boy fishing near a "No Fishing" sign, while in the background two other boys are on their way to church. The subjects were asked: What is the boy thinking about? Responses that may be regarded as significant of individualistic attitudes were obtained from the following:

Case One: "He looks as if he was thinking he had pulled a fast one on the other boys who are going to church. He looks sort of happy and contented. Maybe he's dreaming of what he's going to do. I wouldn't go to church either, because it's all bunk. I never went outside—we have to here—but I certainly won't when I get out again."

Case Four: "He's thinking what a smart fellow he is to be out fishing. He's pretty contented. I'd probably be dreaming. I like to sit and dream. Oh, I don't know what about—just anything."

Case Five: "Why not take a chance if the fishing looks good?"

Case Seven: "There's not much fishing on his mind. He's breaking a rule, of course, but he don't care because he's comfortable. He ought to have some friends there. I don't like to do things by myself."

Case Eight: "He's supposed to be breaking a law, but he looks pretty happy to me. Church don't mean nothing to him. I know when I was in church this morning I was mad. I don't have to go outside, and I don't see why I have to now. I'd be planning something to do for excitement."

Case Ten: "I'd be wondering when the cop would yell at me to get out of there."

Picture Two shows a boy walking in his sleep. The following responses may have significance:

Case One: "He must have stolen something during the day, and now he is worried about the cops."

Case Two: "People walk in their sleep when they have something on their minds. Two couples of us were in Atlantic City staying at a hotel, and the boys were out late.

It must have been on my mind, for I walked down into the lobby in my pajamas. When I stepped on the cold tiles I woke up. I'm nervous and talk a lot in my sleep."

Case Three: "The boy played too hard during the day. Maybe, though, he has some bad habits that make him nervous."

Case Five: "A guilty conscience makes you walk in your sleep. I guess he stole something. No, I never walked in my sleep that I know of."

All other subjects stated that the boy either played too hard or ate something which disagreed with him.

In Picture Three a boy is detained after school to write "I have been a bad boy" on the board, while outside other boys are playing. Interesting leads for further interviews are suggested in the reports below:

Case Three: "Maybe he didn't do his lessons. Whenever I get scolded or punished, I feel like crying. I used to be the same way in school. A boy can finish his punishment like that boy is doing, and then go out to play and forget all about it. I never could."

Case Six: "How he wishes he was out! How I wish I was out of here! I had to stay in after school lots. I'd think, 'Why did I do it?' but I'd do the same thing next day. He'd hurt the teacher if he dared."

Case Eight: "He's sorry now—not because he's being punished, but because he was caught. No one is sorry for what he did unless he is punished. It's awful to be punished so long. How I felt when I knew how long my time would be!"

Picture Four shows a boy passing a cemetery late at night.

Case One said: "I guess he will catch it when he gets home. He's worried about something he's done. Cemeteries and dark places never scare me. No, I'm never scared of anything. I've got good nerves."

Case Two: "I certainly would not be scared. I lived in the country and used to go home late many nights, but I was never afraid of anything."

In general, this picture was the least satisfactory of the series with the group interviewed. None of the individuals pro-

fessed any abnormal fears of darkness or superstitions about ghosts.

In Picture Five two boys are trying to entice a couple of girls to enter their hut. This scene aroused a considerable amount of interest and elicited meaningful smiles.

Case One: "The girls do look sort of bashful, but they'll go in all right. One needs a bit of coaxing. We kids used to play like that. Some never did anything wrong, and others got into serious trouble. I was used to that sort of thing though."

Case Two: "One girl doesn't want to go. The other would be easy. Maybe they're just pretending because they want to be coaxed. This picture shows that there's two kinds of girls. There's not much difference. You can't blame boys for being like that."

Case Five: "Those things start off innocent enough, but they are sure to end up bad. I ought to know."

Case Six: "It couldn't be serious at their age."

Two subjects commented that the girls' mothers should have warned them about the dangers of such actions.

A bully is compelling a smaller child to steal from a peddler's cart in Picture Six.

Case One: "Like a sissy he will steal, and then bring it to the bully. I'd let on I was going to steal, and then run around the corner. No, . . . I guess I'd be too scared. I'd steal then, but try to stay away from the bully afterward."

Case Two: "If anyone told me to steal, and I liked them, I would. Stealing's not in my line, though. It seems cheap."

Case Three: "That big fellow is teaching the kid to steal. Lots of little kids start off that way, and the first thing you know they're stealing all the time. Oh, yes, the kid will steal. He'll get a thrill out of it."

Case Five: "If the boy gets away with it, he will be praised. Then next time he won't have to be coaxed."

Case Seven: "Sure, the kid will steal this time. They do learn to steal that way. Mostly they want to steal, or they wouldn't keep it up. Stealing is a game, especially if you get chased. It's lots of fun."

Case Eight: "That boy's too timid. You have to be a lot fresher than that. He don't know how to steal. You have to begin earlier."

No subject interviewed with the Schwartz pictures suggested that the little boy should inform a policeman or report the matter to his father.

Picture Seven shows a mother and daughter sitting on the porch, while a boy strolls down the walk in tears of rage. The response of Case One was the most vehement:

"You know, more trouble is caused by that sort of favoritism. It's bad for both kids. Around here if an officer likes you, everything you do is perfect. If you aren't liked, everything is wrong. They probably will, and he will to. I know all about that sort of thing."

At this point the subject became highly excited. Her stepmother had made her life almost unbearable in childhood, and she still felt keen resentment towards this woman and a half-sister.

Case Two: "The kid's a fool to show them that he is hurt by that. His mother shouldn't show partiality. I hate that sort of thing."

Case Three: "They must have been fighting. The boy feels bad about it. I hope the mother is giving the girl some good advice. I don't know for sure what I think about being easier on girls than on boys. It may spoil many girls."

Case Four: "The boy ought to get even with his sister the first chance he gets."

Case Five: "If I were that boy, I'd be so mad I'd run away from home. I don't blame the boy for being mad. Of course, it's only a picture, but it sure makes me mad to see such partiality."

Case Six: "Some mothers are partial to boys, though. I don't like that girl's looks. She's gloating over the boy's scolding. He'll go and play with other boys and forget about it, unless it happens too often."

Case Eight: "The boy's mother don't know how to handle him. Some mothers are dumb. I used to get all the atten-

tion at home, and my little brother used to run away all the time."

Case Ten: "Oh, the mother thinks more of the girl than of the boy. My mother thinks more of my brother than of all us six girls put together. He's a swell guy, though. He's in the Army. I guess that kid will have a fist fight and work off his bad feeling."

In the last picture a schoolboy is being tempted to hop a freight by a boy tramp.

Case One: "Maybe he will go just for the excitement. He wouldn't expect to get into no trouble over it. It must be lots of fun to travel. Girls do it now."

Case Two: "I never hopped freights, but it must be fun. All the boys back home used to do it. Girls are different though. That kid ought to go on home. I know that."

Case Three: "If the boy has good training, he'll know better than to hop a freight with the other boy."

Case Four: "That picture reminds me of the time my sister and I went to California. We were just kids. We didn't do no work. We got pretty dirty. People would let us get cleaned up and give us plenty to eat. We finally got home all right. My father said it was a good experience for us. He wasn't worried at all. We met a lot of people. We hopped freights and begged rides in cars. Sure, if I was that boy, I'd go. We only live once."

Case Five: "Boys like that one in the box car always paint the bright side of everything. They pretend that the things they do are all fun. The bigger kid is telling only the good side. It's not all fun. My guess is, though, that the small boy will throw away those books and go. He's sure to be sorry afterwards."

Case Eight: "The kid would cry the first night. He has a good home, and he would be foolish to go on a tramp. Lots of boys have been hurt hopping freights. I hear there's a lot of tramps around now. It must be sort of exciting to be on the go all the time.

Case Ten: "That innocent kid could help him rob. A cop would pull the other boy right away. He would never suspect that little mama's boy. That's why the old boy is wanting him to get on the train."

These samples from the responses of the subjects indicate that the Schwartz interview technique has real value when used with adults. Although the Schwartz pictures were designed for a much younger group and were prepared for use with boys, they do stimulate frank, objective expressions from adult women delinquents. Intermediary material in the form of pictures illustrating social situations might be prepared for use with adults. As yet there appears to be no similar set of pictures with which to establish the desired *rapport* in the initial interview. From a study of the reactions to the Schwartz pictures the interviewer would discover many leads for subsequent psychological studies of the individuals concerned. If this frankness of expression were to be obtained by direct questioning of the individuals, the interviewer would normally expect to spend a considerably longer time in establishing the acquaintance. The use of an intermediary greatly shortens this time, and therefore the technique of Schwartz may well be extended to suit the exigencies of gaining *rapport* with certain types of adults. In addition, the use of appropriate social situations pictures may be helpful in discovering attitudes which might otherwise not be expressed. Finally, the evident interest on the part of the subjects interviewed in this investigation would indicate that the technique has great possibilities.

[The writer desires to acknowledge the invaluable assistance of Miss Myrtle Wampler, who gathered preliminary data used in this report.]

A NOTE ON JOHNSON O'CONNOR'S FORMULA FOR THE STANDARD ERROR OF MEASUREMENT

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JOHNSON O'CONNOR[2] has recently presented, without proof, two new formulas for the standard error of an individual measurement. These formulas will doubtless appeal to many through their simplicity and directness. The purpose of the present paper is to examine into the nature of these formulas, and their validity. In the discussion below, the following notation will be used:

X_1 and X_2 are raw scores on comparable forms of a test. (In subscripts, these symbols will sometimes be replaced simply by the numbers 1 and 2, respectively.)

X_{12} is the *average* raw score of an individual in Tests 1 and 2.

N_1 and N_2 are the total number of scores of the type X_1 and X_2, respectively. Since we assume that each individual has received all tests, $N_1 = N_2 = N$.

In terms of the notation above, O'Connor's first formula (for the case where only two tests have been administered) is:[3]

$$\text{S.E.} = \sqrt{\frac{\Sigma (X_1 - X_{12})^2 + \Sigma (X_2 - X_{12})^2}{N_1 + N_2}} \qquad (1)$$

This formula may be reduced to a more easily recognizable form if we observe that

$$X_1 - X_{12} = X_1 - \frac{X_1 + X_2}{2} = \frac{X_1 - X_2}{2}$$

$$X_2 - X_{12} = X_2 - \frac{X_1 + X_2}{2} = -\frac{X_1 - X_2}{2}$$

And, since the square of any number is equal to the square

[1] The writer is indebted to Dr. Harold D. Carter and Miss Ruth Krause, who have read and criticized the manuscript.

[2] Johnson O'Connor, *Psychometrics*, pp. 114–116. Cambridge: Harvard University Press, 1934.

[3] *Cf.* O'Connor, *op. cit.*, pp. 114–115.

of its negative, $[X_1 - X_{12}]^2 = [-(X_1 - X_{12})]^2$. Hence formula (1) may obviously be rewritten:

$$\text{S.E.} = \sqrt{\frac{2\Sigma\left(\frac{X_1 - X_2}{2}\right)^2}{2N}} = \tfrac{1}{2}\sqrt{\frac{\Sigma (X_1 - X_2)^2}{N}} \quad \ldots\ldots (2)$$

Now, by the definition of a standard deviation

$$\sigma_{(X_1 - X_2)} = \sqrt{\frac{\Sigma [(X_1 - X_2) - M_{(X_1 - X_2)}]^2}{N}} \quad \ldots\ldots (3)$$

But in the case of comparable tests, $M_{(X_1 - X_2)}$ may be taken as zero. Hence, with comparable tests, formula (3) becomes

$$\sigma_{(X_1 - X_2)} = \sqrt{\frac{\Sigma (X_1 - X_2)^2}{N}}$$

and formula (2) is now recognized as $.5\,\sigma_{(X_1 - X_2)}$. In short, O'Connor's formula for the standard error of an individual score, in conventional notation, is

$$\text{S.E.} = .5\,\sigma_{(X_1 - X_2)} \quad \ldots\ldots (4)$$

where X_1 and X_2 are raw scores of individuals in comparable forms of a test. From the point of view of computational ease, formula (4) is very much superior to O'Connor's own expression, formula (1).

O'Connor calls $.5\,\sigma_{(X_1 - X_2)}$ (or its equivalent, as given in (1)) the "S.E.," or "the standard error of a test score" (p. 115). Now, the expression, "the standard error of a test score," has, for over a decade, had a very definite meaning; the recognized formula for the standard error of measurement (assuming comparable forms of a test) is $\sigma_X \sqrt{1 - r_{X_1 X_2}}$.[4] It remains to determine whether O'Connor's new formula is reducible to this established formula. Using the well-known formula for the standard deviation of a correlated difference, and assuming that $\sigma_{X_1} = \sigma_{X_2} = \sigma_X$ (since the forms of the test are assumed comparable),

$$\begin{aligned} \text{S.E.} = .5\,\sigma_{(X_1 - X_2)} &= .5\sqrt{\sigma_{X_1}^2 + \sigma_{X_2}^2 - 2\,\sigma_{X_1}\,\sigma_{X_2}\,r_{X_1 X_2}} \\ &= .5\sqrt{2\,\sigma_X^2\,(1 - r_{X_1 X_2})} \\ &= .707\,\sigma_X \sqrt{1 - r_{X_1 X_2}} \quad \ldots\ldots (5) \end{aligned}$$

[4] H. E. Garrett, *Statistics in Psychology and Education*, pp. 274–276. New York: Longmans Green, 1926.

Thus, *O'Connor's formula reduces to a quantity which is only .707 of the conventional standard error of measurement.* For those who wish it, here is a very simple and convenient way of eliminating thirty per cent of the error of measurement![5]

We proceed to examine O'Connor's formula for the standard error of the average of two tests. For this purpose, the following additional notation is needed:

X_{12}, X_{34}, and X_{1234} are, respectively, the average raw scores of an individual in Tests 1 and 2, in Tests 3 and 4, and in Tests 1–4.

N_{12} and N_{34} are the total number of scores of the type X_{12} and X_{34}. Since we assume that each individual has received all tests, $N_{12} = N_{34} = N$.

By O'Connor's definition (*cf.* formula (1)),

$$\text{S.E. (of average)} = \sqrt{\frac{\Sigma (X_{12} - X_{1234})^2 + \Sigma (X_{34} - X_{1234})^2}{N_{12} + N_{34}}} \quad (6)$$

It will be noticed that formula (6) requires that four tests be administered, in order to determine (by O'Connor's definition) the standard error of the average score in two tests. To obviate this, O'Connor proposes the prediction-formula (we quote):

$$\text{"S.E. (of average)} = \frac{\text{S.E. (of one form)}}{\sqrt{n}} \quad \ldots\ldots (7)$$

where n is the number of forms administered to one individual." Substituting (5) in (7) we get

$$\text{S.E. (of average)} = \frac{.707\, \sigma_X \sqrt{1 - r_{X_1 X_2}}}{\sqrt{n}}$$

and, when $n = 2$,

$$\text{S.E. (of average)} = .5\, \sigma_X \sqrt{1 - r_{X_1 X_2}} \quad \ldots\ldots (8)$$

[5] It would certainly be a poor defense to say that an investigator may define "standard error" in any reasonable way that seems appropriate to him. The use of old terms for new meanings can only lead to confusion. Moreover, the only reasonable definition of *error* of measurement requires a comparison between the fallible or obtained score, and the corresponding *"true" score* (X_∞). The conventional formula for the standard error of measurement involves such a comparison; O'Connor's formula does not.

Since O'Connor offers no proof, the question arises whether formula (6) reduces to formula (8), for $n = 2$.

Following the method of simplification previously employed, we replace $(X_{12} - X_{1234})$ of formula (6) by $\frac{X_{12} - X_{34}}{2}$, and $(X_{34} - X_{1234})$ by $-\frac{X_{12} - X_{34}}{2}$. Then

$$\text{S.E. (of average)} = \sqrt{\frac{2\Sigma\left(\frac{X_{12} - X_{34}}{2}\right)^2}{2N}} = .5\,\sigma_{(X_{12} - X_{34})} \quad \ldots\ldots (9)$$

But

$$\sigma_{(X_{12} - X_{34})} = \sqrt{\sigma^2_{X_{12}} + \sigma^2_{X_{34}} - 2\,\sigma_{X_{12}}\,\sigma_{X_{34}}\,r_{X_{12}X_{34}}}$$

Remembering that "X_{12}" and "X_{34}" are merely brief notations for $\frac{X_1 + X_2}{2}$ and $\frac{X_3 + X_4}{2}$, respectively; and that Tests 1, 2, 3, and 4 are all assumed to be comparable forms of the same test, so that $\sigma_{X_1} = \sigma_{X_2} = \sigma_{X_3} = \sigma_{X_4} = \sigma_X$, $\sigma^2_{X_{12}} = \sigma^2_{X_{34}}$, $r_{X_1X_3} = r_{X_2X_4}$, and (by the Spearman-Brown formula) $r_{X_{12}X_{34}} = \frac{2\,r_{X_1X_2}}{1 + r_{X_1X_2}}$ —it develops that

$$\sigma_{(X_{12} - X_{34})} = \sigma_X \sqrt{1 - r_{X_1X_2}}^{6} \quad \ldots\ldots (10)$$

Substituting (10) in (9), we see that

$$\text{S.E. (of average)} = .5\,\sigma_X \sqrt{1 - r_{X_1X_2}} \quad \ldots\ldots (11)$$

Formula (11), it will be observed, is identical with formula (8), O'Connor's prediction-formula when n equals 2. By a similar process, the prediction-formula can be proved to be in agreement with O'Connor's definition of standard error

[6] The right-hand member of this equation will be recognized as the formula for the standard error of measurement of a single form of a test (Garrett, *op. cit.*). It is an interesting fact that the standard deviation of the difference, $\frac{X_1 + X_2}{2} - \frac{X_3 + X_4}{2}$, equals the standard error of measurement for a single form of a test.

when n equals any integer.[7] O'Connor's formulas are, therefore, of interest if it is desired to know such quantities as $.5\,\sigma_{(X_1 - X_2)}$, $.5\,\sigma_{(X_{13} - X_{24})}$, etc. (*cf.* formulas (4) and (9)). It must be emphasized, however, that these halved standard deviations may not, in any case, be used to replace the conventional standard error of measurement.

[7] Our proof in this paper was limited to the specific case of $n = 2$, principally in order to avoid length or complexity in the notation. The general proof for any number, n, follows exactly that given for $n = 2$. In the general proof, it is desirable to remember (as commented under formula (6)) that O'Connor's definition of the standard error of the average score from n forms of a test, assumes that $2n$ forms of the test have been administered.

DIFFERENCES IN READING ATTAINMENT OF ITALIAN AND JEWISH CHILDREN

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MANY of the children in the New York City schools presenting teaching difficulties in reading are accustomed to hearing a foreign language spoken in the home. The largest group of these is Italian, but in some sections of Manhattan and Brooklyn Jewish is spoken in the homes and on the streets. A comparison is made in this study of the reading attainment of Jewish and Italian children of equal mentality.

The records of 600 Jewish children were taken from the files of the Department of Ungraded Classes. As there were so many more records of Italian children it was possible to pair the number of Jewish children at each mental age level with an equal number of Italian children of the same mental age.

The mental ages of both groups of 600 children ranged from 5 years 6 months to 9 years 11 months on the Binet examination. Their chronological ages ranged from 7 to 14 years and their IQ's from 50 to 95. All of the children in the study had a partial or total reading disability, that is, none of them were able to read as well as the average child in the grade in which they were placed.

A test of reading attainment was given at the same time as the intelligence examination. The range of reading attainment for both groups was from zero to 4A. The median reading attainment in terms of grade placement was 1.18 for the Italian group and 1.40 for the Jewish children.

In order to measure the amount of the reading disability of each group, a tabulation was made of their mental ages and their reading grades. Table I represents the Jewish children and Table II the Italian. Comparison of the reading attainment of the two groups showed that 24 per cent of the Italian

and 19 per cent of the Jewish group were reading below expectation; 26 per cent of the Italian and 25 per cent of the Jewish group were reading at expectation; while 50 per cent of the Italian and 56 per cent of the Jewish group were reading above expectation, considering their mental age.

TABLE I

Comparison between Mental Age and Reading Grade of 600 Jewish Children

MENTAL AGE	READING GRADE							
	0	1A	1B	2A	2B	3A	3B	4A
5–6	17	12	1	0	0	0	0	0
6–0	21	28	6	2	2	1	0	0
6–6	9	46	11	7	3	0	0	0
7–0	13	31	24	13	15	2	0	0
7–6	7	24	27	25	18	17	4	1
8–0	0	13	13	14	24	20	6	5
8–6	3	8	4	6	18	15	9	5
9–0	0	3	0	4	6	10	6	7
9–6	0	0	1	0	4	6	1	2

TABLE 2

Comparison between Mental Age and Reading Grade of 600 Italian Children

MENTAL AGE	READING GRADE							
	0	1A	1B	2A	2B	3A	3B	4A
5–6	17	13	0	0	0	0	0	0
6–0	20	35	2	2	1	0	0	0
6–6	12	47	8	5	4	0	0	0
7–0	14	37	15	19	9	3	1	0
7–6	12	36	19	19	20	12	5	0
8–0	5	17	12	18	18	19	6	0
8–6	0	7	4	12	16	16	12	1
9–0	0	3	2	2	6	16	5	2
9–6	0	2	0	0	3	4	3	2

Another comparison of the reading attainment of the two groups was found by totaling the entire number of terms of acceleration and retardation in reading attainment for each

group. Dividing each total by the number of children accelerated and retarded in the group, both the Jewish and Italian children who were reading above expectation showed an average acceleration of 1.9 terms. Of those who were reading below expectation, the Jewish children showed an average retardation of 1.3 terms and the Italian children of 1.7 terms.

Using the formula for the standard deviation of the difference between two measures, it was found that there were 94 chances in 100 that the difference in reading attainment between the Jewish and Italian children obtained in this study was a true difference and not one of chance, which is sufficiently high to be considered reliable.

SUMMARY

A comparison was made of the reading attainment of Jewish and Italian children of equal mentality, all of whom had a reading disability. An analysis of the reading attainment of the two groups showed a similarity in many ways. The outstanding difference was that 6 per cent more of the Jewish than of the Italian group were reading above expectation, while 5 per cent more of the Italian group were reading below expectation, considering their mental age.

The higher reading attainment of the Jewish children may probably be explained by the social differences between the two races. The Jewish race has clung to their religious belief but has adopted the American customs while the Italians have clung to their national customs. The former race may be classed as verbal, the latter as manual. Since the Jewish people consider education the highest achievement, they are anxious for their children to succeed at school and encourage them to learn to read. However, would it not be possible for the Italian children of equal intelligence to read as well as the Jewish children if given equal stimulation to effort?

POLITICAL PREDICTIONS AND PREFERENCES OF NEW YORK AND LONDON GROUPS*

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INTRODUCTION

AN experiment was run off in New York and London shortly before the elections of 1932 in this country to compare the American and British outlook upon our political situation in 1932. Only very limited segments and samplings of the populations were reached but nevertheless the results are quite indicative of political tendencies here and in England in 1932. Lasswell remarked that the "rôle of opinion in international politics is peculiarly worthy of study, because it is a matter of growing importance. . . . Interests overlap boundaries."[1] This experiment is a step toward measurement of the extent to which American and British political interests overlap.

The experiment also embodied data from the *Literary Digest* straw vote polls in 1932 as propaganda material in order to determine the effect of true and false information on the political outlook.

THE EXPERIMENT

At Columbia College 210 undergraduates indicated the the party they believed and also the party they wished would win in the 1932 elections. This part of the experiment was conducted by Professor Gardner Murphy.

The London experiment was conducted by the writer. At Toynbee Hall 58 members of the Workers' Educational Asso-

* This experiment was carried out under a fellowship of the Social Science Research Council, 1932–33.

[1] Harold D. Lasswell, *Propaganda Technique in the World War* (1927), p. 6.

ciation participated.[2] At the London School of Economics and Political Science[3] 77 members of the general students' organization and 25 members of the labor club were included in the experiment. The London experiment consisted of two ballot forms with an interval for propaganda in between. The first ballot is reproduced here:

AMERICAN ELECTIONS.

In the coming elections in the United States, there are several parties contending for victory. Which party do you BELIEVE will win the elections?

PARTY AND CANDIDATE FOR PRESIDENT.

(Underline one)

1. *COMMUNIST* (Foster)
2. *DEMOCRATIC* (Roosevelt)
3. *REPUBLICAN* (Hoover)
4. *SOCIALIST* (Thomas)
5. *OTHER PARTIES* (Coxey or Reynolds or Upshaw)

In the coming elections in the United States, there are several parties contending for victory. Which party do you WISH to win the national elections?

PARTY AND CANDIDATE FOR PRESIDENT

(Underline one)

1. *COMMUNIST* (Foster)
2. *DEMOCRATIC* (Roosevelt)
3. *REPUBLICAN* (Hoover)
4. *SOCIALIST* (Thomas)
5. *OTHER PARTIES* (Coxey or Reynolds or Upshaw)

[2] Through the courtesy of J. J. Mallon, Warden, Toynbee Hall, London.

[3] Through the courtesy of Professor H. J. Laski, London School of Economics and Political Science. This experiment indirectly originated in a conference with Professor Laski concerning a study of the outlook of experts in which he suggested that an inquiry be made of the views of M. P.'s as to the results of the next parliamentary elections to be held in Great Britain.

After the *first ballot* forms were collected, information forms were distributed. Approximately half of a group received copies of the *true information form* and the other half received the *false information form*. The subjects did not know that there were two different forms. The true information form only is included here:

AMERICAN ELECTIONS.

The LITERARY DIGEST Straw Vote Poll.

The LITERARY DIGEST— a leading American weekly, is once more conducting a preliminary election poll of straw votes in an attempt to forecast the results of the coming presidential election in the United States. As in 1924, and in 1928, the last elections, the LITERARY DIGEST is making every effort to forecast even the proportion of the total votes received by the several candidates. This poll is an excellent barometer of the American political behavior. The October 8th, October 15th, and October 22nd issues of this weekly show Roosevelt leading the poll.

Results of the Literary Digest Straw Vote Poll

PARTY & CANDIDATE	NUMBER OF VOTES Reported in the Literary Digest issue		
	Oct. 8th	Oct. 15th	Oct. 22nd
Communist (Foster)	4,777	11,385	13,569
Democratic (Roosevelt)	404,992	1,062,087	1,473,446
Republican (Hoover)	325,845	781,431	973,367
Socialist (Thomas)	53,122	106,352	127,235
Other Parties (Coxey, Reynolds, & Upshaw)	9,353	22,379	43,237*

* Approximate total miscellaneous party vote.

In the false information form the votes received by Hoover and Roosevelt were switched around so that the following untrue figures were contained in the false information form (in which it was stated that "the October 8th, October 15th, and October 22nd issues of this weekly show Hoover leading

the poll'' and otherwise was identical with the true information form):

Democratic (Roosevelt)	325,845	781,431	973,367
Republican (Hoover)	404,992	1,067,087	1,473,446

The second ballot forms were distributed after an interval for examination of the information forms. The second ballot was the same as the first ballot except that it had in addition the following two questions relating to the next British elections:

In the next general British parliamentary elections (whenever that should occur) what party do you WANT to win? .....

In the next general British parliamentary elections (whenever that should occur) what part do you THINK will win? .....

True information only was given in the experiment with the labor group at the London School of Economics.

TABLE I

American Elections of 1932

Percentage distribution of the expectations (upper part) and of the preferences (lower part) concerning the outcome of the 1932 elections.

AMERICAN PARTY	TOYNBEE HALL (LONDON)	LONDON SCHOOL OF ECONOMICS		COMBINED LONDON GROUPS	COLUMBIA COLLEGE (N. Y.)
		Students' Organization	Labor Club		
Predictions					
Republican	36.2	15.6	8.0	21.9	33.3
Democratic	56.9	79.2	88.0	72.5	66.2
Socialist	3.5	0	4.0	1.9	0
Communist	3.5	5.2	0	3.8	0.5
Preferences					
Republican	10.3	19.7	16.0	15.7	32.4
Democratic	34.5	26.3	16.0	27.7	25.2
Socialist	31.0	35.5	44.0	35.2	41.0
Communist	24.1	18.4	24.0	21.4	1.4

AMERICAN ELECTIONS OF 1932

Two-thirds of the Columbia undergraduate group and more than two-thirds of the London groups predicted Roosevelt's victory. Percentages for the various London groups and for the Columbia College group are given in Table I which is based on the results on the *first ballot*.

COMPARISON OF THE NEW YORK AND LONDON GROUPS

The Columbia and London groups were more similar in their predictions than in their preferences. The latter were much more radically inclined. Only 1.4 per cent of the Columbia undergraduates wanted a communist victory as compared to more than one-fifth of the London groups that wanted a communist victory here.

OUTLOOK ON THE NEXT BRITISH ELECTIONS

The political outlook of the London groups on the next British elections can be determined from the data on the last two questions of the *second ballot*. Percentages of the groups according to the British parties that they had expected and had wanted to win the next elections are given in Table II.

If the percentages for the London groups in Tables I and II should be compared then it could be seen that the radicalism of the London groups was somewhat cut down in their outlook on American political affairs and that it was much more sharply cut down in their *expectations* than in their *preferences*. A socialist or communist victory in the United States was predicted by only 5.7 per cent of the London groups although 62 per cent had predicted a similar victory in the next British elections. Certainly that contrast is much greater than the contrast between their American and British preferences: 72.9 per cent of the London groups had preferred a socialist or communist victory in Great Britain and 56.6 per cent had preferred a similar victory here. This comparison of the American and British political outlook of the London groups is quite contrary to the conventional notion

TABLE II

The Next General Elections in Great Britain

Percentage distribution of the expectations (upper part) and of the preferences (lower part) concerning the outcome of the next general British elections.

BRITISH PARTY	TOYNBEE HALL	LONDON SCHOOL OF ECONOMICS		COMBINED LONDON GROUPS
		Students' Organization	Labor Group	
Predictions				
Conservative	31.4	28.4	17.4	27.7
National	1.7	4.1	13.0	4.5
Liberal	3.5	9.5	0	5.8
Labor	60.5	50.0	69.6	56.8
Communist	3.5	8.1	0	5.2
Preferences				
Conservative	6.9	16.2	4.4	11.0
National	1.7	2.7	0	1.9
Liberal	15.5	17.6	0	14.2
Labor	56.9	46.0	65.2	52.9
Communist	19.0	17.6	30.4	20.0

of a high correlation between *wish* and *belief*. It also implies that the London groups were aware of differences between political conditions here and in Great Britain especially that there is no powerful labor or radical party in American politics.

POLITICAL PREDICTION AND PREFERENCE

Various relations between American and British political preferences and predictions of the London groups can be shown by the coefficient of mean square contingency as in Table III.

If we array in a continuous order the American political parties so that the list would begin with the most conservative and would end with the most radical of the parties then we should have the following series: republican (most conservative), democratic, socialist, and communist (most radical).

TABLE III

Political Prediction and Preference

Association between American and British political predictions and preferences of the London School of Economics and Toynbee Hall groups —coefficient of mean square contingency.

ASSOCIATIONS	LONDON SCHOOL OF ECONOMICS*	TOYNBEE HALL
Preference in American and in British elections†	.66**	.65
Prediction of American and of British elections	.64	.73
Prediction of and preference in British elections	.60	.53
Prediction of British and preference in American elections	.58	.45
Prediction of and preference in American elections‡	.48	.50

* Excludes the labor group.

† Prediction of American and preference in British elections, both groups combined, C = .49.

‡ Columbia College group, C = .27.

** If correctly interpreted, the sign of all the coefficients is positive. The figures here are for the *coefficient of mean square contingency* which may vary from 0 (no association) to 1 (complete association).

Similarly we could arrange the British parties in the following order: conservative (least radical), nationalist (a coalition with a basic representation of the conservative party), liberal, labor, communist (most radical). If, as is shown below, there is a strong connection between the outlook on political affairs at home and abroad then we should expect that most of the London individuals who had desired a communist victory in the next British election would also desire a communist victory in our elections. Besides we should also expect that most of the London individuals who had desired a triumph of the Conservative party in Great Britain should have desired a triumph of the Republican party here. The coefficient of mean square contingency for the relation between the preference in American and British elections

is .66 for the London School of Economics groups and .65 for the Toynbee Hall group. It indicates that London individuals had quite similar sympathies in both American and British political affairs. They tended to be rather equally conservative or moderate or radical in their American and British political preferences. Table III is by no means conclusive. Our classification of the political parties is somewhat arbitrary in nature. Nor is it fine enough for statistical conclusiveness nor are the numbers upon which the results are based large enough.

OUTLOOK ON POLITICAL AFFAIRS AT HOME AND ABROAD

A general similarity between the home and foreign political outlook is suggested by the data of this experiment. This was already intimated in discussing the association between the preference of the London groups in the 1932 American and in the next British elections. It is also indicated by the fact that a majority of the London groups wanted a radical government here and in Great Britain.

PROPAGANDA AND POLITICAL OPINION

A comparison of the results on the first and second ballots indicates the effects of the true and false information forms or the effect of simple and objective propaganda on political attitudes and opinion. Predictions were changed to a greater extent in the sections given the true information than in the sections given the false information forms. After they were given the true information form there was a change of prediction by 62.5 per cent and 40 per cent of the Toynbee Hall and London School of Economics groups respectively. They switched their predictions from a republican to a democratic victory from the first to the second ballots. On the other hand in the sections given the false information form 37 per cent of the Toynbee Hall and 16.7 per cent of the London School of Economics individuals changed their predictions of a democratic to a republican victory from the first

to the second ballots. No changes in political preferences followed either the true or false information form except in four instances. This implies that propaganda on similar levels cannot be expected to affect sharply or at all the basic political tendencies or inclinations of a community or nation. Effective political propaganda must be much more powerful and penetrating.

CONCLUSIONS

The London groups had as good an insight into the trends in our 1932 election campaign as did the Columbia College group. In political outlook the former were much more radical than the latter. Political predictions are much more subject to change by information than are political desires. There is no definite or invariable association between political predictions and desires. True information is more effective than false information in changing political predictions. In this experiment the difference may be due to the previous publication in the newspapers of the *true* or of similar information. Neither true nor false information alone change political preferences. A similarity in political sympathies with respect to home and foreign affairs is indicated.

NEWS AND NOTES

A correction. Attention has been called to a statement in the News section of the June 1935 issue of this *Journal* which is apt to be slightly misleading. The *Journal* erred in stating that "The Library of Congress in Washington recently announced a new service which makes available to anyone any material in the Library of Congress in the form of outlines, typewritten copies, summaries, or actual photostatic copies of the original, etc." The item should have stated that Mr. Laurence E. Tomlinson, a member of the staff of the Library, is offering this research service independently of the Library and is devoting considerable time to this work outside of office hours.

Fathers and mothers in the United States today have many more opportunities of learning how to be better parents than did their own fathers and mothers, or their grandparents. This announcement was made upon the completion of a study of Parent Education Opportunties by Ellen C. Lombard, of the office of Education Specialist in Parent Education, United States Office of Education. Many colleges and universities have created departments and offer courses in parent education. They furnish tested knowledge of various aspects of child development and guidance. Among the institutions offering such courses are Columbia University, University of Minnesota, State University of Iowa, University of California, Yale University, and many others.

Dr. Edward L. Thorndike, Teachers College, Columbia University, has recently presented in his new book, "Adult Interests," many interesting findings concerning the mental powers and habits of grown people. The changes of depth of interests, their control and mastery of uninteresting learning, inventories of likes and dislikes are matters of real moment to every live person over twenty-one years of age. Dr. Thorndike was assisted by the staff of the Division of Psychology of the Institute of Educational Research in the collecting of the material for this publication.

Two publications of interest to educators and citizens concerned with school problems have been issued recently by the Federal Office of Education, Washington, D. C. The first, Pamphlet No. 59, "Legislation Concerning Free Textbooks," lists States with free textbook laws, summarizes arguments pro and con, and takes up the problem of textbook selection and uniformity. It also provides a digest of laws affecting the compositions of State boards and other agencies for the selection of textbooks.

In 1817 Philadelphia provided free textbooks for its school children. By 1934, twenty-five states and the District of Columbia had the same provision.

"Federal Grants for Education, 1933–34," Leaflet No. 34, is a study made primarily to supply information to persons desiring to know the extent of expenditures by the Federal Government for education. The Federal Emergency Relief Administration allowed nearly $25,000,000 for the emergency education program, student aid, and rural school continuation. The distribution of this amount by States is given in this pamphlet.

BOOK REVIEWS

MANDEL SHERMAN. *Mental Hygiene and Education.* Longmans Green and Co. 1934. Pp. vii–295.

Aware of the growing interest on the part of psychologists and psychiatrists in the problems of childhood in the field of education and mental hygiene and seeing the need of psychiatric knowledge on the part of the teacher the author has attempted to meet this need in bringing together in one volume information for the teacher. In the author's own words, "this book has been planned to aid teachers to discover and understand the emotional and personality problems of their pupils and to institute classroom treatment. It also describes the kinds of problems which cannot be dealt with adequately in the classroom, and should be referred to a psychiatrist for treatment."

The author begins his book by analyzing some of the psychiatric problems in education and emphasizes in chapter 1 the need for education in reality. He sees in an ideal educational system the new-born and his parents enrolled in that system. Then the home and the school will cooperate in unifying educational experiences of the child. Chapter 2 deals with emotional adjustment. The position taken is that specific emotions develop psychogenetically out of undirected aimless activity. Chapters 3 and 4 give an analysis of the development of personality and the way personality manifests itself. Theories of Kretschmer, Adler, and Freud regarding the development of personality are summarized. In the manifestation of personality timid and hysterical children are discussed. Chapter 6 is devoted to the methods and techniques of differentiating and measuring personality.

Chapters 5 and 7 deal with attitudes and conflicts. "It is impossible to generalize about the attitudes of an individual," says the author, "although attitudes may cluster about a general pattern. . . ." In most cases we have attitudes towards conditions like war, authority, etc. Attitudes may result in conflicts; especially if an attempt is made to redirect them. "A conflict," says the author, "is an unpleasant emotional attitude toward the discrepancy between opposing desires or between desires and attainment. . . ." Although conflicts are normal, and may be useful as motivating devices, if they cannot be satisfactorily solved they may lead to personality disorders of a serious nature. It is the detrimental conflicts which should be spotted and the victim taught a better way of reacting. One must learn to accept defeat if one is to develop the ability to solve his conflicts satisfactorily. In chapter 8 is found an analysis of compensatory behavior and defense reactions. Compensatory behavior may take two forms, that of attempting to excel in a trait in which one

feels deficient or in developing other traits to divert attention from a deficiency. "Because phantasy is often a compensation for frustration and involves events outside the immediate environment some psychiatrists maintain it is closely related to mental complexes of the abnormal," says the author in chapter 9 on phantasy. Again, "A child may be considered abnormal when his phantasies become persistent and symbolic, for he has then escaped completely into a world of unreality where events and occasions of everyday life play but an incidental rôle in his behavior." It is a question of degree of phantasy or of conflicts whether or not they become maladjusting.

In chapter 10 on neurotic behavior the author has the following to say: "The symptoms of a neurotic child develop on a psychogenic basis, that is, as a result of his previous experiences, attitudes and emotional reactions." Feelings of insecurity, sex conflicts, etc., result in neurotic symptoms. The difficulty here as elsewhere in abnormal behavior, as the reviewer sees it, is that symptomatology does not explain the behavior mechanism involved. In chapter 11 the author deals with symbolic behavior but points out the fact that the psychiatrist is concerned only with symbols which are used but are not understood by those who employ them. Hysterical and dream symbols are discussed. Chapter 12 analyzes the problems of adolescence. Chapter 13 treats of conduct disorders of children in the home and in the school.

Throughout this work the author has used factual data when obtainable. These data have been interpreted in the light of his clinical experiences. Further, these interpretations have been applied to educational problems. The book is rich in illustrative case material of a representative sort. The author has brought together a fund of scientific information in the field of mental hygiene and put it into understandable form for those who are interested in education.

JAMES R. PATRICK,
Ohio University.

LAUGIER, H., PIÉRON, H., PIÉRON, MME. H., TOULOUSE, E., ET WEINBERG, D. *Études Docimologiques sur le Perfectionnement des Examens et Concours.* Publications du *Travail Humain*, Serie A, no. 3, 1934, 88 pp.

The monograph comprises seven chapters under separate authorship, all bearing on the problems of examinations but with no effort to integrate them into a unified discussion. Comment will be made on these chapters seriatim.

(1) Piéron, Mme. Piéron and Laugier discuss school marks and entrance board exams as related to psychological tests. The correlations with tests are low. This might have been expected, for the tests were of the "Woodworth and Wells" vintage or types included in Whipple's

manual. The authors conclude that entrance examinations are of doubtful value.

(2) Laugier and Weinberg show the unreliability of grading done by two teachers. While the distributions are normal and the correlation is fairly high, there are some striking discrepancies and one teacher is the much more lenient. The writers plead for more objective examinations. They admit that this problem has been studied already in America but present their study as the first of its kind in France.

(3) Piéron coins the term "docimologie" to denote the science and technique of examinations. He suggests worth-while problems for study such as written *vs.* oral exams, scale values, qualifications of examiners, and the use of psychological tests in predicting academic success. The reviewer is surprised to learn that such a program has not been under way for years.

(4) Laugier and Weinberg pursue the unreliability of exams further, showing that other graders have lower correlations than the two mentioned above in Chapter 2. One teacher grading the same papers a second time after three years showed marked discrepancies. The authors suggest that examiners should be trained for the job.

(5) Piéron expands his "docimologie" to include tests of aptitudes as well as proficiencies and shows their relation to educational guidance.

(6) Laugier, Toulouse and Weinberg describe the recent field of "Biotypologie" which includes a comprehensive examination of the individual by specialists in anthropometry, morphology, sexology, physiological chemistry, physiology, medicine and psychology. Composite profiles including 39 variables are shown for good, average and poor pupils. The good pupils show superiority in the psychological variables and a possible inferiority in many of the others but the results are complicated by the age factor. The general idea of biotypology seems very promising, provided a comprehensive program could be carried out on a large number of individuals. The authors give some of the intercorrelations but do not go into such problems as weighing the variables for academic prediction. They mention Spearman's method but do not elaborate at all the question of factor analysis which would seem to be a most obvious next step.

(7) Laugier and Weinberg study sex differences in science marks. The boys' distribution shows greater variability but the means of all the grades for each sex show little difference.

The studies reported in the monograph are interesting and well done but most of the ground has been covered already in this country. Perhaps it was worthwhile to repeat the work with a different racial and language group. From the standpoint of promoting a scientific program in education doubtless a local study would have much more weight in France.

The point which most interests the reviewer is the biotypology movement. A society was founded in 1932 and the program looks like cooperative research on a broad scale. If the society lives up to the program advertised on the inside cover of the present monograph it will be worth watching.

HAROLD E. BURTT,
Ohio State University.

COLEMAN R. GRIFFITH. *An Introduction to Applied Psychology.* Macmillan, 1934, xv + 679.

The first question which arises in connection with an Applied Psychology text designed for college courses is what types of material should be included. No two such texts agree more than fractionally, either as to the selection of content or as to the emphasis given common topics. One writer will have several chapters on Educational Psychology, while another feels that this field is better left for books specializing on that topic alone. While nearly all books in Applied Psychology include Personnel and Salesmanship, but one writer will have half a dozen chapters on one or the other, while others may devote less than a single chapter.

The reviewer having written one such text is naturally prejudiced in favor of his own choice of materials, and will feel that Professor Griffith, or any other writer, has neglected some important matters and included others which are of lesser value in Applied Psychology as it stands at present. The reader, therefore, is warned to take ensuing comments with as many grains of salt as he feels necessary.

The first main section of six chapters is logically chosen from problems in the "Psychology in Student Life." The main topics are on automobile driving, athletics, relaxation and sleep, motivation, vocational guidance, and how to study. This is a rather miscellaneous collection, but a similar collection might be directed against the whole field of Applied Psychology, since it grasps all psychological facts which may be applied to personal or business betterment.

Griffith's last section, "The Basic Material of Applied Psychology," is full of very valuable material, such as original nature, learning, methods of psychological experimentation, and a final chapter on problems of human fellowship. This last discusses the general rôle of science in life, comparing with charlatanism, religion, and social decline. Personally, I would prefer this whole section to come first in the book, as it contains much material which should serve to give a point of view to last during the entire reading, as well as certain fundamental information which can be referred to time and again in connection with practical matters of human adjustment. If the author wished to plunge directly into the subject and arouse the reader's immediate interest, as he did, he might have

placed the last section in second place, rather than trying to form a point of view after all the factual material has been presented.

Parts II and V, "Psychology and Social Problems" and "Psychology and Education," are subjects to the criticism of involving material not usually considered as properly within the scope of Applied Psychology. Those dealing with social problems are not especially practical, and are very central to another major field of applied psychology. Race and sex differences might logically be included, not as topics for their own sake, but to accompany vocational or personnel problems. The chapters on learning are well chosen to give practical suggestions on important matters of learning and education which might otherwise be missed by those who do not study Education by itself.

The parts on Law, Medicine, and Industry and Commerce are, in my opinion, the best sections in the book. The material is well chosen, discussed, and pertains directly to what are usually considered among the most central topics of applied psychology. The reviewer would like to have seen Vocational Guidance be given a position of equal prominence with these important topics. Prof. Griffith has included only one short chapter in Part I.

As to the general style and method of presentation, the book is well written and interesting. The reader is carried along nicely and attention seldom lags. Occasionally, there is too much space consumed in introducing the new topic, with sociological and economic discussion bulking fairly large before concentrating on the psychological. This is rather important in this case, as the chapters are all fairly short and numerous, there being 40 in 661 pages, meaning only about 16 pages to a chapter.

Also we might suggest that Professor Griffith's extensive research in athletics has been allowed to color the whole book, often in places where one can see virtually no connection. For example, the chapter on race differences begins with a lengthy analogy of the mixed population of the United States as presenting the same problem as that of a coach in welding together a football line of men whose reaction times in starting are similar enough to form a unit in charging. I think the analogy is so far-fetched that nothing was gained. It might have been simpler to discuss individual differences in more abstract fashion.

R. W. Husband,
University of Wisconsin.

Bills, A. G. *General Experimental Psychology.* Longmans, Green & Co. 1934. 620 pages. $4.00.

The impression gained from reading this book is that it is a valuable contribution to the field of *general* experimental psychology. The author has wilfully omitted material for abnormal and animal psychology and

attempts to limit its scope to material concerning the normal, human adult. The author's style is such that the book is clear and easily read.

The first two parts of the book deal with sensory and perceptual processes respectively. These parts combined occupy approximately one fourth of the total number of pages. The brevity of part two, dealing with the "perceptual process," is quite apparent, since only about one twelfth of the entire volume is devoted to all of this material. The topics of cutaneous space perception and time perception could have been expanded with distinct advantage. The other subject matter which seems to be treated too briefly is that of affection which is dismissed with nine pages.

Adequate space is allowed to parts three and four which are devoted to discussions of learning and memory and association and thought. The organization of the presentation of these topics is excellent. The main body of the book consists of the two parts mentioned above plus a part dealing with work and fatigue. The latter part could be very useful as supplementary reading for a course in industrial psychology.

A more extensive and complete treatment of psychophysical methods would have been an improvement. Appendix B, approximately three pages, is assigned to cover this subject.

The book is well illustrated with photographs of apparatus and a great many graphical presentations of experimental results. There are twenty-nine chapters and two appendices while lists of references, well chosen, appear at the end of each chapter. Author and subject indices are included.

The author's reaction to Gestalt psychology seems to be unfavorable, for he has omitted the mention of a great many of the experimental findings of this school. However, "General Experimental Psychology" could well serve as a text-book for a course in experimental psychology, or certainly as a good source for collateral reading for such a course.

K. W. Oberlin,
University of Delaware.

NEW BOOKS AND PAMPHLETS RECEIVED

Books and pamphlets for review should be sent to JAMES P. PORTER, *Editor*, JOURNAL OF APPLIED PSYCHOLOGY, Ohio University, Athens, Ohio.

Behavior Development in Infants. EVELYN DEWEY. Columbia University Press, New York City, 1935. $3.50. 321 pp.

Essential Traits of Mental Life. TRUMAN L. KELLEY. Harvard University Press, Cambridge, Mass., 1935. $2.75. 145 pp.

Experimental Psychology: An Introduction. PAUL F. FINNER. Prentice-Hall, New York, 1935. $2.00. 268 pp.

The National Association of Vocational Education of China, 1935. 80 Route Voyron, Shanghai, China. 60 pp.

New Armor for Old: An Autobiography. WILLIAM O'SULLIVAN MOLONEY. Henry Holt & Company, New York, 1935. $3.00. 442 pp.

Personality Maladjustments and Mental Hygiene. J. E. WALLACE WALLIN. McGraw-Hill Book Company, New York, 1935. $3.00. 511 pp.

Principles of Abnormal Psychology: Revised. EDMUND S. CONKLIN. Henry Holt & Company, New York, 1935. $3.00. 527 pp.

Principles of Animal Psychology. N. R. F. MAIER AND T. C. SCHNEIRLA. McGraw-Hill Book Company, New York, 1935. $4.00. 529 pp.

Psychological Foundations of Education. J. STANLEY GRAY. American Book Company, New York, 1935. 534 pp.

Psychology and Life. S. C. MITRA. Indian Journal of Psychology, January, 1935. 27 pp.

The Range of Human Capacities. DAVID WECHSLER. Williams & Wilkins Company, Baltimore, Md., 1935. $2.50. 159 pp.

Student's Guide for Beginning the Study of Psychology. WILLARD LEE VALENTINE, JAMES H. TAYLOR, KENNETH H. BAKER AND FRANK N. STANTON. Prentice-Hall, New York, 1935. 267 pp.

The Theory and Practice of Student Counseling. HUGH M. BELL. Stanford University Press, Stanford University, California. $1.00. 138 pp.

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Comparative Psychology Monographs—Baltimore: Johns Hopkins University Press. Subscription $5. 400 pages per volume. Knight Dunlap, Managing Editor. Published without fixed dates, each number a single research. Founded 1922.

Genetic Psychology Monographs—Worcester, Mass.: Clark University Press. Subscription $7.00 per volume. One volume per year. Edited by Carl Murchison. Bi-monthly. Each number one complete research. Child behavior, animal behavior and comparative psychology. Founded 1925.

Psychological Abstracts—Eno Hall, Princeton, N. J. American Psychological Association. Subscription $6.00. 700 pages ann. Edited by W. S. Hunter and R. R. Willoughby. Monthly. Abstracts of psychological literature. Founded 1927.

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Personnel Journal—Baltimore: The Williams & Wilkins Co. Subscription $5.00. 500 pages, approximately. Edited by Walter V. Bingham. Bi-Monthly.

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Journal of Educational Psychology—Baltimore, Md.: Warwick & York. Subscription $6.00. Edited by Jack W. Dunlap, Harold E. Jones, and Percival M. Symonds. Published monthly except June to August. Founded 1910.

Child Development—Baltimore, Md.: Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Buford Johnson. Quarterly. Founded 1930.

Character and Personality—Durham, N. C.: Duke University Press. Subscription $2.00 per annum. Quarterly. Edited by Robert Saudek (London) and Ernest Seeman (Durham, N. C.). Founded 1932.

The Psychological Exchange—11 East 125th Street, New York, N. Y. Subscription $3.00 per annum. Bi-monthly. Edited by James Hargan. Founded 1932.

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American Journal of Psychology—Ithaca, N. Y.: Cornell University. Subscription $6.50. 624 pages annually. Edited by M. F. Washburn, K. M. Dallenbach, M. Bentley, E. G. Boring. Quarterly. General and experimental psychology. Founded 1887.

Journal of General Psychology—Worcester, Mass.: Clark University Press. Subscription $14.00 per annum; $7.00 per volume. 1,000 pages annually (2 volumes). Edited by Carl Murchison and an international cooperating board. Quarterly. Experimental, theoretical, clinical, and historical psychology. Founded 1927.

Psychological Review—Princeton, N. J.: Psychological Review Company. Subscription $5.50. 540 pages annually. Bi-monthly. General Psychology. Edited by Herbert S. Langfeld. Founded 1894.

Psychological Monograph—Princeton, N. J.: Psychological Review Company. Subscription $6.00 per vol. 500 pp. Ed. by Joseph Peterson. Published without fixed dates, each issue one or more researches. Founded 1895.

Psychological Index—Princeton, N. J.: Psychological Review Company. Subscription $4.00. 300–400 pp. Edited by W. S. Hunter and R. R. Willoughby. An annual bibliography of psychological literature. Founded 1895.

Psychological Bulletin—Princeton, N. J.: Psychological Review Company. Subscription $6.00. 720 pages annually. Psychological literature. Monthly (10 numbers). Edited by John A. McGeoch. Founded 1904.

Archives of Psychology—New York: Columbia University.
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Journal of Abnormal and Social Psychology—Emo Hall, Princeton, N. J.: American Psychological Association. Subscription $5. Foreign, $5.25. Editor, Henry T. Moore. Quarterly. 448 pages annually. Abnormal and Social. Founded 1906.

Psychological Clinic—Philadelphia: Psychological Clinic Press.
Subscription $3.00. 288 pages. Ed. by Lightner Witmer. Without fixed dates (Quarterly). Orthogenics, psychology, hygiene. Founded 1907.

Psychoanalytic Review—Washington, D. C.: 3617 10th St., N. W.
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Journal of Experimental Psychology—Princeton, N. J. Psychological Review Company. 900 pages annually. Experimental. Subscription $7.00. Bi-monthly. Edited by S. W. Fernberger. Founded 1916.

Journal of Applied Psychology—Lancaster, Pa.: Science Press Printing Co. Subscription $6.00. 600 pages annually. Bi-monthly. Edited by James P. Porter, Ohio University, Athens, Ohio. Founded 1917.

Journal of Comparative Psychology—Baltimore: The Williams & Wilkins Co. Subscription $5.00 per volume of 450 pages. Two volumes every year. Edited by Knight Dunlap and Robert M. Yerkes. Founded 1921.

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